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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Contents

Foreword

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

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should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies requirements for support of Radio Resource Management for the FDD and TDD modes of New Radio (NR). These requirements include requirements on measurements in NR and the UE as well as requirements on node dynamical behaviour and interaction, in terms of delay and response characteristics.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[2] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[3] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[4] 3GPP TS 38.215: "NR; Physical layer measurements".

[5] 3GPP TS 38.533: "NR; User Equipment (UE) conformance specification; Radio Resource Management (RRM)".

[6] 3GPP TS 38.211: "NR; Physical channels and modulation”.

[7] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[8] 3GPP TS 38.212 "NR; Multiplexing and channel coding".

[9] 3GPP TS 38.202: "NR; Physical layer services provided by the physical layer".

[10] 3GPP TS 38.300: "NR; Overall description; Stage-2".

[11] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[12] 3GPP TS 38.423: "NG-RAN; Xn Application Protocol (XnAP)".

[13] 3GPP TS 38.104: "NR; Base Station (BS) radio transmission and reception".

[14] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[15] 3GPP TS 36.133: "Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[16] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC) protocol specification".

[17] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity", Stage 2.

[18] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[19] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[20] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[21] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".

[22] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[23] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation".

[24] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA); Overall description".

[25] 3GPP TS 36.101: "Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

[26] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[27] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".

[28] Void.

[29] 3GPP TS 25.133: "Requirements for Support of Radio Resource Management (FDD)".

[30] 3GPP TS 25.302: "Services provided by the Physical Layer".

[31] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA), Evolved Universal Terrestrial Radio Access (E-UTRA) and Next Generation Radio Access; Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2".

[32] 3GPP TS 25.214: "Physical layer procedures (FDD)".

[33] 3GPP TS 37.213: "Physical layer procedures for shared spectrum channel access"

[34] 3GPP TS 37.355: "LTE Positioning Protocol (LPP) ".

[35] 3GPP TS 38.455 : "NG-RAN; NR Positioning Protocol A (NRPPa) ".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [11] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [11].

Active DL BWP: Active DL bandwidth part as defined in TS 38.213 [3].

Blackbox Approach: Testing methodology, in which the UE internal implementation of certain specific UE functionality involved in the test, is unknown.

Control Resource Set: As defined in TS 38.213 [3].

DL BWP: DL bandwidth part as defined in TS 38.213 [3].

EN-DC: E-UTRA-NR Dual Connectivity as defined in clause 4.1.2 of TS 37.340 [17].

en-gNB: As defined in TS 37.340 [17].

FR1: Frequency range 1 as defined in clause 5.1 of TS 38.104 [13].

FR2: Frequency range 2 as defined in clause 5.1 of TS 38.104 [13].

gNB: as defined in TS 38.300 [10].

LMF: as defined in TS 38.305 [22].

Master Cell Group: As defined in TS 38.331 [2].

Multi-Radio Dual Connectivity: Dual Connectivity between E-UTRA and NR nodes, or between two NR nodes, as defined in TS 37.340 [17].

ng-eNB: As defined in TS 38.300 [10].

NE-DC: NR-E-UTRA Dual Connectivity as defined in clause 4.1.3.2 of TS 37.340 [17].

NGEN-DC: NG-RAN E-UTRA-NR Dual Connectivity as defined in clause 4.1.3.1 of TS 37.340 [17].

NR-DC: NR-NR Dual Connectivity as defined in clause 4.1.3.3 of TS 37.340 [17].

Primary Cell: As defined in TS 38.331 [2].

Quasi Co-Location: As defined in TS 38.214 [26].

RLM-RS resource: A resource out of the set of resources configured for RLM by higher layer parameter RLM-RS-List [2] as defined in TS 38.213 [3].

SA operation mode: Operation mode when the UE is configured with at least PCell and not any MR-DC.

Secondary Cell: As defined in TS 38.331 [2].

Secondary Cell Group: As defined in TS 38.331 [2].

Serving Cell: As defined in TS 38.331 [2].

SMTC: An SSB-based measurement timing configuration configured by *SSB-MeasurementTimingConfiguration* as specified in TS 38.331 [2].

Special Cell: As defined in TS 38.331 [2].

SSB: SS/PBCH block as defined in clause 7.8.3 of TS 38.211 [6].

Timing Advance Group: As defined in TS 38.331 [2].

3.2 Symbols

For the purposes of the present document, the following symbols apply:

[…]	Values included in square bracket must be considered for further studies, because it means that a decision about that value was not taken.
$BW_{Channel}$	Channel bandwidth, defined in TS 38.101-1, 38.101-2 and 38.101-3 subclause 3.2
Ês	Received energy per RE (power normalized to the subcarrier spacing) during the useful part of the symbol, i.e. excluding the cyclic prefix, at the UE antenna connector
Io	The total received power density, including signal and interference, as measured at the UE antenna connector.
Ioc	The power spectral density (integrated in a noise bandwidth equal to the chip rate and normalized to the chip rate) of a band limited noise source (simulating interference from cells, which are not defined in a test procedure) as measured at the UE antenna connector.
Iot	The received power spectral density of the total noise and interference for a certain RE (power integrated over the RE and normalized to the subcarrier spacing) as measured at the UE antenna connector
N_{oc}	The power spectral density of a white noise source (average power per RE normalised to the subcarrier spacing), simulating interference from cells that are not defined in a test procedure, as measured at the UE antenna connector
n_{PRB}	Physical Resource Block number as defined in clause 3.2 in TS 38.211.

N_{TA}	Timing offset between uplink and downlink radio frames at the UE, as defined in clause 4.2 in TS 38.213.
$N_{\mathrm{TA\ offset}}$	Fixed timing advance offset, as defined in clause 7.1.2.2 in TS 38.133.
P_{CMAX}	Configured UE transmitted power as defined in clause 6.2.4 in TS 38.101-1, 38-101-2 and 38.101-3.
$P_{CMAX,c}$	Configured UE transmitted power on a serving cell *c* as defined in clause 6.2.4 in TS 38.101-1, 38-101-2 and 38.101-3
S	Cell Selection Criterion defined in TS 38.304, subclause 5.2.3.2 for NR
SSB_RP	Received (linear) average power of the resource elements that carry NR synchronisation burst, measured at the UE antenna connector
Srxlev	Cell selection RX level, defined in TS 38.304, subclause 5.2.3.2
Squal	Cell selection quality, defined in TS 38.304, subclause 5.2.3.2
Sintrasearch	Defined in TS 38.304 , subclause 5.2.4.7 for E-UTRAN amd 38.304 subclause 5.2.4.7 for NR
Snonintrasearch	Defined in TS 38.304 , subclause 5.2.4.7
$Thresh_{x, high}$	Defined in TS 38.304 , subclause 5.2.4.7
$Thresh_{x, low}$	Defined in TS 38.304 , subclause 5.2.4.7
$Thresh_{serving, low}$	Defined in TS 38.304 , subclause 5.2.4.7
$T_{RE\text{-}ESTABLISH\text{-}REQ}$	The RRC Re-establishment delay requirement, the time between the moment when erroneous CRCs are applied, to when the UE starts to send preambles on the PRACH.
T_c	Basic time unit, defined in clause 4.1 of TS 38.211 [6].
T_s	Reference time unit, defined in clause 4.1 of TS 38.211 [6].
$T_{reselection}$	Defined in TS 25.304, subclause 5.2.6.1.5
$T_{reselectionRAT}$	Defined in TS 36.304 , subclause 5.2.4.7
$T_{reselectionEUTRA}$	Defined in TS 36.304 , subclause 5.2.4.7
$T_{reselectionUTRA}$	Defined in TS 36.304 , subclause 5.2.4.7
$T_{reselectionGERAN}$	Defined in TS 36.304 , subclause 5.2.4.
$Thresh_{x, high}$	Defined in TS 38.304 , subclause 5.2.4.7
$Thresh_{x, low}$	Defined in TS 38.304 , subclause 5.2.4.7
$Thresh_{serving, low}$	Defined in TS 38.304 , subclause 5.2.4.7
$T_{UE\_re\text{-}establish\_delay}$	Time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [11] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [11].

AoA	Angle of Arrival
AoD	Angle of Departure
BFD	Beam Failure Detection
BFD-RS	BFD Reference Signal
BLER	Block Error Rate
BM-RS	Beam Management Reference Signal
BWP	Bandwidth Part
CA	Carrier Aggregation
CBD	Candidate Beam Detection
CBW	Channel Bandwidth
CC	Component Carrier
CCA	Clear Channel Assessment
CLI	Cross Link Interference
CMR	Channel Measurement Resource
CORESET	Control Resource Set
CP	Cyclic Prefix
CSI	Channel-State Information
CSI-RS	CSI Reference Signal
CSI-RSRP	CSI Reference Signal based Reference Signal Received Power

CSI-RSRQ	CSI Reference Signal based Reference Signal Received Quality
CSI-SINR	CSI Reference Signal based Signal to Noise and Interference Ratio
CSI_RP	Received (linear) average power of the resource elements that carry NR CSI-RS signals and channels, measured at the UE antenna connector
DC	Dual Connectivity
DCI	Downlink Control Information
DL	Downlink
DL-AoD	Downlink Angle-of-Departure
DL-TDOA	Downlink Time Difference Of Arrival
DMRS	Demodulation Reference Signal
DRX	Discontinuous Reception
E-CID	Enhanced Cell ID
E-UTRA	Evolved UTRA
E-UTRAN	Evolved UTRAN
EN-DC	E-UTRA-NR Dual Connectivity
FDD	Frequency Division Duplex
FR	Frequency Range
HARQ	Hybrid Automatic Repeat Request
HO	Handover
IMR	Interference Measurement Resource
L1-RSRP	Layer 1 RSRP
L1 SL-RSRP	Layer 1 Sidelink RSRP which corresponds to PSCCH-RSRP and/or PSSCH-RSRP
LMF	Location Management Function
LPP	LTE Positioning Protocol
MAC	Medium Access Control
MCG	Master Cell Group
MDT	Minimization of Drive Tests
MG	Measurement Gap
MGL	Measurement Gap Length
MGRP	Measurement Gap Repetition Period
MIB	Master Information Block
MN	Master Node
MR-DC	Multi-Radio Dual Connectivity
NE-DC	NR-E-UTRA Dual Connectivity
NGEN-DC	NG-RAN E-UTRA-NR Dual Connectivity
NR	New Radio
NR-DC	NR-NR Dual Connectivity
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
OTDOA	Observed Time Difference Of Arrival
PBCH	Physical Broadcast Channel
PCC	Primary Component Carrier
PCell	Primary Cell
PDCCH	Physical Downlink Control Channel
PDSCH	Physical Downlink Shared Channel
PLMN	Public Land Mobile Network
PRACH	Physical RACH
PRS	Positioning Reference Signal
PRS-RSRP	Positioning Reference Signal based Reference Signal Received Power
PSBCH	Physical Sidelink Broadcast Channel
PSBCH-RSRP	Physical Sidelink Broadcast Channel DMRS based Reference Signal Received Power
PSCCH	Physical Sidelink Control Channel
PSCCH-RSRP	Physical Sidelink Control Channel DMRS based Reference Signal Received Power
PSCell	Primary SCell
PSS	Primary Synchronization Signal PSS Primary Synchronization Signal
PSSCH	Physical Sidelink Shared Channel
PSSCH-RSRP	Physical Sidelink Shared Channel DMRS based Reference Signal Received Power
pTAG	Primary Timing Advance Group
PUCCH	Physical Uplink Control Channel
PUSCH	Physical Uplink Shared Channel
QCL	Quasi Co-Location
RACH	Random Access Channel

RAT	Radio Access Technology
RLM	Radio Link Monitoring
RLM-RS	Reference Signal for RLM
RMSI	Remaining Minimum System Information
RRC	Radio Resource Control
RRM	Radio Resource Management
RSSI	Received Signal Strength Indicator
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSTD	Reference Signal Time Difference
RTT	Round Trip Time
S-SSB	Sidelink Synchronization Signal Block
S-SSB_RP	Received (linear) average power of the resource elements that carry NR S-SSB signals and channels, measured at the UE antenna connector
SA	Standalone operation mode
SCC	Secondary Component Carrier
SCell	Secondary Cell
SCG	Secondary Cell Group
SCS	Subcarrier Spacing
SCS_{SSB}	SSB subcarrier spacing
SDL	Supplementary Downlink
SFN	System Frame Number
SFTD	SFN and Frame Timing DifferenceSI System Information
SIB	System Information Block
SL-RSSI	Sidelink Received Signal Strength Indicator
SLSS	Sidelink Synchronization Signal
SMTC	SSB-based Measurement Timing configuration
SpCell	Special Cell
SRS	Sounding Reference Signal
SRS-RSRP	Sounding Reference Signal based Reference Signal Received Power
SS-RSRP	Synchronization Signal based Reference Signal Received Power
SS-RSRQ	Synchronization Signal based Reference Signal Received Quality
SS-SINR	Synchronization Signal based Signal to Noise and Interference Ratio
SSB	Synchronization Signal Block
SSB_RP	Received (linear) average power of the resource elements that carry NR SSB signals and channels, measured at the UE antenna connector.
SSS	Secondary Synchronization Signal
sTAG	Secondary Timing Advance Group
SUL	Supplementary Uplink
TA	Timing Advance
TAG	Timing Advance Group
TCI	Transmission Configuration Indicator
TDD	Time Division Duplex
TDOA	Time Difference Of Arrival
TRP	Transmission-Reception Point
TTI	Transmission Time Interval
UE	User Equipment
UL	Uplink

3.4 Test tolerances

The requirements given in the present document make no allowance for measurement uncertainty. The test specification 38.533 [5] defines the test tolerances.

3.5 Frequency bands grouping

3.5.1 Introduction

The intention with the frequency band grouping below is to increase the readability of the specification.

The frequency bands grouping is derived based on UE REFSENS requirements specified in [18, 19, 20] and assuming 0.5 dB step between the neighbour groups. The groups are defined in the order of increasing REFSENS, i.e., the group A has the smallest REFSENS among the groups. For the same SCS and a given bandwidth, the bands within the same group have the same Io conditions in a corresponding requirement in this specification, provided the bands support this SCS. For different SCSs supported by a frequency band and the same bandwidth, different Io conditions may apply for the frequency band in the requirements, while the band group is the same, based on the lowest REFSENS requirement normalized by the number of subcarriers among its supported SCSs for this bandwidth. For the same SCS but different supported bandwidths, the group for a band is determined based on the lowest REFSENS requirement normalized by the number of subcarriers among its supported bandwidths.

3.5.2 NR operating bands in FR1

NR frequency bands grouping for FR1 is specified in Table 3.5.2-1.

Table 3.5.2-1: NR frequency band groups for FR1

Group	NR FDD		NR TDD		NR SDL	
	Band group notation	Operating bands	Band group notation	Operating bands	Band group notation	Operating bands
A	NR_FDD_FR1_A	n1, n18, n70, n74^4, n91, n92, n93, n94	NR_TDD_FR1_A	n34, n38^9, n39, n40, n50, n51, n53	NR_SDL_FR1_A	n75, n76
B	NR_FDD_FR1_B	n65, n66, n74^3	NR_TDD_FR1_B	n38^7	NR_SDL_FR1_B	-
C	NR_FDD_FR1_C	n30	NR_TDD_FR1_C	n48, n77^1, n78, n79	NR_SDL_FR1_C	-
D	NR_FDD_FR1_D	n28	NR_TDD_FR1_D	n77^2	NR_SDL_FR1_D	-
E	NR_FDD_FR1_E	n2, n5, n7	NR_TDD_FR1_E	n41, n90	NR_SDL_FR1_E	-
F	NR_FDD_FR1_F	n26^6	NR_TDD_FR1_F	-	NR_SDL_FR1_F	-
G	NR_FDD_FR1_G	n3, n8, n12, n14, n20, n71	NR_TDD_FR1_G	-	NR_SDL_FR1_G	n29
H	NR_FDD_FR1_H	n25	NR_TDD_FR1_H	-	NR_SDL_FR1_H	-
I	NR_FDD_FR1_I	-	NR_TDD_FR1_I	n46,n96^Editor's Note	NR_SDL_FR1_I	-
J	NR_FDD_FR1_J	-	NR_TDD_FR1_J	n47^8	NR_SDL_FR1_J	-

NOTE 1: Except 3.8 GHz to 4.2 GHz.
NOTE 2: Only 3.8 GHz to 4.2 GHz.
NOTE 3: Except 1475.9 MHz to 1510.9 MHz.
NOTE 4: Only when the band is confined in 1475.9 MHz to 1510.9 MHz.
NOTE 5: These bands are used only in NR carrier aggregation with other NR bands according to NR CA band combinations specified in TS 38.101-1 [18] and TS 38.101-3 [20].
NOTE 6: The minimum Io condition is reduced by 0.5 dB when the carrier frequency of the assigned NR channel bandwidth is within 865-894 MHz.
NOTE 7: When this band is only used for V2X SL service, the band is exclusively used for NR V2X in particular regions.
NOTE 8: This band is unlicensed band used for V2X service. There is no expected network deployment in this band.
NOTE 9: When this band is only used for WAN service.
Editor's Note: If different reference sensitivity value is defined for n96 than n46, then n96 will be moved to a different band group e.g. NR_TDD_FR1_J

3.5.3 NR operating bands in FR2

NR frequency bands grouping for FR2 is specified in Table 3.5.3-1.

Table 3.5.3-1: NR frequency band groups for FR2

Group	Band group notation	Operating bands
A	NR_TDD_FR2_A	n257[1], n258[1], n261[1]
B	NR_TDD_FR2_B	n257[4], n258[4], n261[4]
C	NR_TDD_FR2_C	
D	NR_TDD_FR2_D	
E	NR_TDD_FR2_E	
F	NR_TDD_FR2_F	n260[4]
G	NR_TDD_FR2_G	n260[1]
H	NR_TDD_FR2_H	
I	NR_TDD_FR2_I	
J	NR_TDD_FR2_J	
K	NR_TDD_FR2_K	
L	NR_TDD_FR2_L	n257[2], n258[2], n261[2]
M	NR_TDD_FR2_M	
N	NR_TDD_FR2_N	
O	NR_TDD_FR2_O	
P	NR_TDD_FR2_P	
Q	NR_TDD_FR2_Q	
R	NR_TDD_FR2_R	
S	NR_TDD_FR2_S	
T	NR_TDD_FR2_T	n257[3], n258[3], n261[3]
U	NR_TDD_FR2_U	
V	NR_TDD_FR2_V	
W	NR_TDD_FR2_W	
X	NR_TDD_FR2_X	
Y	NR_TDD_FR2_Y	n260[3]
Z	NR_TDD_FR2_Y	
AA	NR_TDD_FR2_AA	n259[3]
NOTE 1: UE power class 1. NOTE 2: UE power class 2. NOTE 3: UE power class 3. NOTE 4: UE power class 4.		

3.6 Applicability of requirements in this specification version

In this specification,

- ‘cell’, ‘PCell’, ‘PSCell’ and ‘SCell’ refer to NR cell, NR PCell, NR PSCell, and NR SCell,
- E-UTRA cells are referred to as ‘E-UTRA cell’, ‘E-UTRA PCell’, ‘E-UTRA PSCell’, and ‘E-UTRA SCell’,
- E-UTRA-NR dual connectivity where E-UTRA is the master is referred to as ‘E-UTRA-NR dual connectivity’ or ‘EN-DC’.
- NR-NR dual connectivity which involves two gNB acting as Master gNB and Secondary gNB is referred to as “NR-NR dual connectivity” or “NR-DC”. NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.
- ‘active serving cell’ refers to PCell, PSCell and activated SCells

For UE configured with supplementary UL, the requirements in clause 7.1 and 7.3 shall also apply to uplink transmissions on supplementary UL.

Unless explictly stated, requirements do not apply when CCA is used on serving or neighbour cells.

3.6.1 RRC connected state requirements in DRX

For the requirements in RRC connected state specified in this version of the specification, the UE shall assume that no DRX is used provided the following conditions are met:

- DRX parameters are not configured or

- DRX parameters are configured and
  - *drx-InactivityTimer* is running or
  - *drx-RetransmissionTimerDL* is running or
  - *drx-RetransmissionTimerUL* is running or
  - *ra-ContentionResolutionTimer* is running or
  - a Scheduling Request sent on PUCCH is pending or
    - a PDCCH indicating a new transmission addressed to the C-RNTI of the MAC entity has not been received after successful reception of a Random Access Response for the preamble not selected by the MAC entity

Otherwise the UE shall assume that DRX is used.

3.6.2 Number of serving carriers

3.6.2.1 Number of serving carriers for SA

Requirements for standalone NR with NR PCell are applicable for the UE configured with the following number of serving NR CCs:

- up to 8 NR DL CCs in total, with 1 UL (or 2 UL if SUL is configured) in PCell and up to 1 UL (or 2 UL if SUL is configured) in SCell.
- SUL may be configured together with one of the UL

3.6.2.2 Number of serving carriers for EN-DC

Requirements for EN-DC operation of E-UTRA and NR with E-UTRA PCell and NR PSCell are applicable for the UE configured with the following number of serving NR CCs:

- up to 7 NR DL CCs in total, with 1 UL (or 2 UL if SUL is configured) in PSCell and up to 1 UL (or 2 UL if SUL is configured) in SCell in different FR with PSCell.
- SUL may be configured together with one of the UL

The applicable number of E-UTRA CC for EN-DC in the MCG for both UL and DL is specified in TS 36.133 [15].

3.6.2.3 Number of serving carriers for NE-DC

Requirements for NE-DC operation of NR and E-UTRA with NR PCell and E-UTRA PSCell are applicable for the UE configured with the following number of serving NR CCs:

- up to 7 NR DL CCs in total, with 1 UL (or 2 UL if SUL is configured) in PCell and up to 1 UL (or 2 UL if SUL is configured) in SCell.
- SUL may be configured together with one of the UL

The applicable number of E-UTRA CC for NE-DC in the SCG for both UL and DL is specified in TS 36.133 [15].

3.6.2.4 Number of serving carriers for NR-DC

Requirements for NR-DC are applicable for the UE configured with the following number of serving NR CCs:

- up to 2 NR DL CCs in total in FR1, up to 8 NR DL CCs in total in FR2, with 1 UL in PCell, 1 UL in PSCell, and up to 1 UL in each SCell.

3.6.3 Applicability for intra-band FR2

For the requirements in RRC connected state specified in this version of the specification, UE shall assume that the transmitted signals from the serving cells should have the same downlink spatial domain transmission filter on one OFDM symbol in the same band in FR2. Otherwise, the UE is not supposed to satisfy any requirements for SCell.

3.6.4 Applicability for FR2 UE power classes

For the requirements of each FR2 power class specified in this version of the specification, certain UE types with specific device architectures are assumed. The UE types can be found in TS 38.101-2 [19].

3.6.5 Applicability for SDL bands

The measurements accuracy requirements for SDL bands in this version of specification in clause 10.1 shall apply for NR intra-frequency measurements on SCC (SS-RSRP, SS-RSRQ, SS-SINR, and L1-RSRP) and inter-frequency measurements (SS-RSRP, SS-RSRQ, and SS-SINR).

3.6.6 Applicability of requirements for NGEN-DC operation

All the requirements in this specification applicable for EN-DC are also applicable for NGEN-DC.

3.6.7 Applicability of QCL

For the requirements specified in this version of the specification, a reference signal is considered to be QCLed to another reference signal if it is in the same TCI chain as the other reference signal, provided that the number of Reference Signals in the chain is no more than 4. It is assumed there is single QCL type per TCI chain.

A TCI chain consists of an SSB, and one or more CSI-RS resources, and the TCI state of each Reference Signal includes another Reference Signal in the same TCI chain.

DMRS of PDCCH or PDSCH is QCLed with the reference signal in its active TCI state and any other reference signal that is QCLed, based on above criteria, with the reference signal in the active TCI state.

3.6.8 Applicability of 2-step RA and 4-step RA in RRM requirements

Unless explicitly stated otherwise the requirements under the following clauses, where the UE transmits random acess to NR serving cell or NR target cell, are applicable for both 2-step RA and 4-step RA procedures [3]:

- Handover requirements in clause 6.1, except for clause 6.1.2
- RRC connection mobility control requirements in clause 6.2, except for clause 6.2.2,
- UE transmit timing requirements in clause 7.1,
- PScell addition delay requirements in clause 8.9.2,
- PSCell change requirements in clause 8.11 and
- Conditional PSCell change requirements in clause 8.11B.

3.6.9 Applicability of requirements for scheduling availability

The scheduling availability requirements in clause 8.1.7.3, 8.5.7.3, 8.5.8.3, 9.2.5.3.3 and 9.5.6.3 are not applicable if any of the following condition is met:

- The network configures simultaneous UL/DL between two FR2 bands if the UE does not have the capability of supporting *simultaneousRxTxInterBandCA.*
- The network configures mixed numerology on two FR2 CCs if the UE does not have the capability of supporting simultaneous reception with two different numerologies between FR2 CCs in DL.

3.6.10 Applicability of requirements for measurement restrictions

The requirements for measurement restrictions in clause 8.1.2.3, 8.1.3.3, 8.5.2.3, 8.5.3.3, 8.5.5.3, 8.5.6.3, 9.5.5 and 9.8.5 are not applicable if the following condition is met:

- The network configures mixed numerology on two CCs if the UE does not have the capability of supporting simultaneous reception with different numerologies between the two CCs in DL.

4 SA: RRC_IDLE state mobility

4.1 Cell Selection

After a UE has switched on and a PLMN has been selected, the Cell selection process takes place, as described in TS 38.304 [1]. This process allows the UE to select a suitable cell where to camp on in order to access available services. In this process, the UE can use stored information (*Stored information cell selection*) or not (*Initial cell selection*).

4.2 Cell Re-selection

4.2.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in either *Camped Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity

In the requirements of clause 4.2, the exceptions for side conditions apply as follows:

- for the UE capable of CA, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.1, B.3.2.3, or B.3.2.5 for UE supporting CA in FR1, CA in FR2 and CA between FR1 and FR2, respectively;

- for the UE capable of SUL, the applicable exceptions for side conditions are specified in Annex B, clause B.3.4.1 for UE supporting SUL in FR1.

4.2.2 Requirements

4.2.2.1 UE measurement capability

For idle mode cell re-selection purposes, and for UE supporting *IdleInactiveMeasurements-r16* or *idleInactiveEUTRA-MeasReport-r16*, for NR CA and MR-DC measurement purpose, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and

- Depending on UE capability, 7 NR inter-frequency carriers, and

- Depending on UE capability, 7 FDD E-UTRA inter-RAT carriers, and

- Depending on UE capability, 7 TDD E-UTRA inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC_IDLE state shall be capable of monitoring a total of at least 14 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers.

4.2.2.2 Measurement and evaluation of serving cell

The UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1*N1 DRX cycle; where:

M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle ≤ 0.64 second,

otherwise M1=1.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE has evaluated according to Table 4.2.2.2-1 in N_{serv} consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information for 10 s, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1].

Table 4.2.2.2-1: N_{serv}

DRX cycle length [s]	Scaling Factor (N1)		N_{serv} [number of DRX cycles]
	FR1	FR2[Note1]	
0.32	1	8	M1*N1*4
0.64		5	M1*N1*4
1.28		4	N1*2
2.56		3	N1*2
Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length.			

4.2.2.3 Measurements of intra-frequency NR cells

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP and SS-RSRQ measurements of the identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS38.304 [1] within T_{detect,NR_Intra} when that Treselection= 0 . An intra frequency cell is considered to be detectable according to the conditions defined in Annex B.1.2 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every $T_{measure,NR\_Intra}$ (see table 4.2.2.3-1 or table 4.2.2.3-2) for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR\_Intra}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined in TS38.304 [1] within $T_{evaluate,NR\_Intra}$ when $T_{reselection}$ = 0 as specified in table 4.2.2.3-1 or table 4.2.2.3-2 provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3dB better ranked in FR1 or 4.5dB better ranked in FR2.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

- if there are multiple such cells, the cell has the highest rank among them.
    - the cell is at least 3dB better ranked in FR1 or 4.5dB better ranked in FR2 if the current serving cell is among them.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If $T_{reselection}$ timer has a non zero value and the intra-frequency cell is satisfied with the reselection criteria which are defined in TS38.304 [1], the UE shall evaluate this intra-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

For UE not configured with *highSpeedMeasFlag-r16*, T_{detect,NR_Intra}, $T_{measure,NR\_Intra}$ and $T_{evaluate,\ NR\_intra}$ are specified in Table 4.2.2.3-1. For UE configured with *highSpeedMeasFlag-r16*, T_{detect,NR_Intra}, $T_{measure,NR\_Intra}$ and $T_{evaluate,\ NR\_intra}$ are specified in Table 4.2.2.3-2.

Table 4.2.2.3-1: T_{detect,NR_Intra}, $T_{measure,NR\_Intra}$ and $T_{evaluate,NR\_Intra}$

DRX cycle length [s]	Scaling Factor (N1)		T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR\_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR\_Intra}$ [s] (number of DRX cycles)
	FR1	FR2^Note1			
0.32	1	8	11.52 x N1 x M2 (36 x N1 x M2)	1.28 x N1 x M2 (4 x N1 x M2)	5.12 x N1 x M2 (16 x N1 x M2)
0.64		5	17.92 x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56		3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1.					

Table 4.2.2.3-2: T_{detect,NR_Intra}, $T_{measure,NR\_Intra}$ and $T_{evaluate,NR\_Intra}$ for UE configured with *highSpeedMeasFlag-r16* (Frequency range FR1)

DRX cycle length [s]	T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR\_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR\_Intra}$ [s] (number of DRX cycles)
0.32	2.56 x M2 (8 x M2)	0.32 x M3 (1 x M3)	0.96 x M4 (3 x M4)
0.64	5.12 (8)	0.64 (1)	1.92 (3)
1.28	8.96 (7)	1.28 (1)	3.84 (3)
2.56	58.88 (23)	2.56 (1)	7.68 (3)
Note 1: when SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2			

4.2.2.4 Measurements of inter-frequency NR cells

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher\_priority\_search}$ where $T_{higher\_priority\_search}$ is described in clause 4.2.2.7.

If Srxlev $\leqslant$ $S_{nonIntraSearchP}$ or Squal $\leqslant$ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS38.304 [1] within $K_{carrier}$ * T_{detect,NR_Inter} if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least 5 dB in FR1 or 6.5dB in FR2 for reselections based on ranking or 6dB in FR1 or 7.5dB in FR2 for SS-RSRP reselections based on absolute priorities or 4dB in FR1 and 4dB in FR2 for SS-RSRQ reselections based on absolute priorities.

The parameter $K_{carrier}$ is the number of NR inter-frequency carriers indicated by the serving cell. The parameter $K_{carrier}$ for a UE configured with idle mode CA measurements (while T331 is running), is the combined number of NR inter-frequency carriers indicated by the serving cell and the number of NR inter-frequency carriers configured for idle mode CA measurements.

Note: combined total number means that if a carrier is a high priority carrier and additionally a carrier configured for idle mode CA measurements, it only counts as one carrier.

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.3 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR\_Inter}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier}$ * $T_{measure,NR\_Inter}$ (see table 4.2.2.4-1) for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR\_Inter}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 [1] within $K_{carrier}$ * $T_{evaluate,NR\_Inter}$ when $T_{reselection} = 0$ as specified in table 4.2.2.4-1 provided that the reselection criteria is met by

- the condition when performing equal priority reselection and

  when *rangeToBestCell* is not configured:

  - the cell is at least 5dB better ranked in FR1 or 6.5dB better ranked in FR2 or.

  when *rangeToBestCell* is configured:

    - the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

      - if there are multiple such cells, the cell has the highest rank among them

      - the cell is at least 5dB better ranked in FR1 or 6.5dB better ranked in FR2 if the current serving cell is among them. or

- 6dB in FR1 or 7.5dB in FR2 for SS-RSRP reselections based on absolute priorities or

- 4dB in FR1 or 4dB in FR2 for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If $T_{reselection}$ timer has a non zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in Table 4.2.2.4-1 under the following conditions:

- $T_{SMTC\_intra} = T_{SMTC\_inter}$ = 160 ms; where T_{SMTC_intra} and T_{SMTC_inter} are periodicities of the SMTC occasions configured for the intra-frequency carrier and the inter-frequency carrier respectively, and
- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and
- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS38.304 [1].

Table 4.2.2.4-1: T_{detect,NR_Inter}, $T_{measure,NR\_Inter}$ and $T_{evaluate,NR\_Inter}$

DRX cycle length [s]	Scaling Factor (N1)		T_{detect,NR_Inter} [s] (number of DRX cycles)	$T_{measure,NR\_Inter}$ [s] (number of DRX cycles)	$T_{evaluate,NR\_Inter}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x 1.5 (36 x N1 x 1.5)	1.28 x N1 x 1.5 (4 x N1 x 1.5)	5.12 x N1 x 1.5 (16 x N1 x 1.5)
0.64		5	17.92x N1 (28 x N1)	1.28 x N1 (2 x N1)	5.12 x N1 (8 x N1)
1.28		4	32 x N1 (25 x N1)	1.28 x N1 (1 x N1)	6.4 x N1 (5 x N1)
2.56		3	58.88 x N1 (23 x N1)	2.56 x N1 (1 x N1)	7.68 x N1 (3 x N1)
Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length.					

4.2.2.5 Measurements of inter-RAT E-UTRAN cells

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-RAT E-UTRAN layers of higher priority at least every $T_{higher\_priority\_search}$ where $T_{higher\_priority\_search}$ is described in clause 4.2.2.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-RAT E-UTRAN layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT E-UTRAN layers shall be the same as that defined below for lower priority RATs.

The requirements in this clause apply for inter-RAT E-UTRAN FDD measurements and E-UTRA TDD measurements. When the measurement rules indicate that inter-RAT E-UTRAN cells are to be measured, the UE shall measure RSRP and RSRQ of detected E-UTRA cells in the neighbour frequency list at the minimum measurement rate specified in this clause.

Theparameter $N_{EUTRA\_carrier}$ is the total number of configured E-UTRA carriers indicated to meet non high speed requirements in the neighbour frequency list. The parameter $N_{EUTRA\_carrier\_HST}$ is the total number of configured E-UTRA carriers indicated to meet high speed requirements in the neighbour frequency list. If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$, an inter-RAT E-UTRAN layer is indicated to meet high speed requirements if highSpeedMeasFlag-r16 is configured and the carrier to be measured is configured with highSpeedEUTRACarrier-r16. If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$, UE is required to meet non high speed requirements no matter whether highSpeedMeasFlag-r16 or highSpeedEUTRACarrier-r16 is configured or not. The parameter $N_{EUTRA\_carrier}$ for a UE configured with idle mode CA measurements (while T331 is running), is the combined number of configured E-UTRA carriers in the neighbour frequency list and E-UTRA carriers configured for idle mode CA measurements.

Note: combined total number means that if a carrier is a high priority carrier and additionally a carrier configured for idle mode CA measurements, it only counts as one carrier.

The UE shall filter RSRP and RSRQ measurements of each measured E-UTRA cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least half the minimum specified measurement period.

An inter-RAT E-UTRA cell is considered to be detectable provided the following conditions are fulfilled:

- the same conditions as for inter-frequency RSRP measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band, and

- the same conditions as for inter-frequency RSRQ measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band.
- SCH conditions specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band

The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS38.304 [1] within $N_{EUTRA\_carrier\_HST}$ * $T_{detect,EUTRAN\_HST}$ + $N_{EUTRA\_carrier}$ * $T_{detect,EUTRAN}$ when Srxlev ⩽ $S_{nonIntraSearchP}$ or Squal ⩽ $S_{nonIntraSearchQ}$ when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

Cells which have been detected shall be measured at least every $N_{EUTRA\_carrier\_HST}$ * $T_{measure,EUTRAN\_HST}$ + $N_{EUTRA\_carrier}$ * $T_{measure,EUTRAN}$ when Srxlev ⩽ $S_{nonIntraSearchP}$ or Squal ⩽ $S_{nonIntraSearchQ}$.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,EUTRAN}$. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell.

If the UE detects on an inter-RAT E-UTRAN carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall not consider an inter-RAT E-UTRA cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For a cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that an already identified inter-RAT E-UTRA cell has met reselection criterion defined in TS 38.304 [1] within $N_{EUTRA\_carrier\_HST}$ * $T_{evaluate,EUTRAN\_HST}$ + $N_{EUTRA\_carrier}$ * $T_{evaluate,EUTRAN}$ when $T_{reselection}$ = 0 as speficied in table 4.2.2.5-1 and 4.2.2.5-2 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

If $T_{reselection}$ timer has a non zero value and the inter-RAT E-UTRA cell is satisfied with the reselection criteria which are defined in TS 38.304 [1], the UE shall evaluate this E-UTRA cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2.2.5-1: $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$, and $T_{evaluate,EUTRAN}$

DRX cycle length [s]	$T_{detect,EUTRAN}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN}$ [s] (number of DRX cycles)
0.32	11.52 (36)	1.28 (4)	5.12 (16)
0.64	17.92 (28)	1.28 (2)	5.12 (8)
1.28	32(25)	1.28 (1)	6.4 (5)
2.56	58.88 (23)	2.56 (1)	7.68 (3)

Table 4.2.2.5-2: $T_{detect,EUTRAN\_HST}$, $T_{measure,EUTRAN\_HST}$, and $T_{evaluate,EUTRAN\_HST}$ for UE configured with highSpeedMeasFlag-r16

DRX cycle length [s]	$T_{detect,EURAN\_HST}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN\_HST}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN\_HST}$ [s] (number of DRX cycles)
0.32	4.16 (13)	0.64 (2)	0.96 (3)
0.64	7.68 (12)	1.28 (2)	1.92 (3)
1.28	8.96 (7)	1.28 (1)	3.84 (3)
2.56	58.88 (23)	2.56 (1)	7.68 (3)

4.2.2.6 Maximum interruption in paging reception

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed $T_{SI\text{-}NR} + 2*T_{target\_cell\_SMTC\_period}$ ms.

At inter-RAT cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels for paging reception of the target inter-RAT cell. For NR to E-UTRAN cell re-selection the interruption time must not exceed $T_{SI\text{-}EUTRA}$ + 55 ms.

$T_{SI\text{-}NR}$ is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for an NR cell.

$T_{SI\text{-}EUTRA}$ is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [16] for an E-UTRAN cell.

These requirements assume sufficient radio conditions, so that decoding of system information can be made without errors and does not take into account cell re-selection failure.

4.2.2.7 General requirements

The UE shall search every layer of higher priority at least every $T_{higher\_priority\_search} = (60 * N_{layers})$ seconds, where N_{layers} is the total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information.

For a UE configured with early measurement reporting, while T331 is running, N_{layers} is the combined total number of higher priority NR and E-UTRA carrier frequencies broadcasted in system information and carriers configured for idle mode CA measurements.

Note: combined total number means that if a carrier is a high priority carrier and additionally a carrier configured for idle mode CA measurements, it only counts as one carrier.

4.2.2.8 Minimum requirement at transitions

When switching from low mobility scenario or not-at-cell-edge scenario to low mobility and not-at-cell-edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to low mobility scenario or not-at-cell-edge scenario over measurement period ($T_{relaxed}$) and thereafter switch to requirements corresponding to low mobility and not-at-cell-edge scenario. The measurement period, $T_{relaxed}$, is any of:

- $T_{measure,NR\_Intra}$ and $T_{evaluate,NR\_Intra}$, defined in section 4.2.2.9 for intra-frequency measurements on NR cells,
- $T_{measure,NR\_Inter}$ and$T_{evaluate,NR_Inter}$ defined in section 4.2.2.10 for inter-frequency measurements on NR cells and
- $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ defined in sections 4.2.2.11 for inter-RAT E-UTRAN measurements.

When switching from low mobility and not-at-cell-edge scenario to low mobility scenario or not-at-cell-edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to low mobility scenario or not-at-cell-edge scenario upon fulfilling the switching criteria.

When switching from normal mode to low mobility scenario or not-at-cell-edge scenario or low mobility and not-at-cell-edge scenario during cell-reselection period, the UE shall fulfill the requirements corresponding to normal mode over measurement period (T_{normal}) and thereafter switch to requirements corresponding to low mobility scenario or not-at-cell-edge scenario or low mobility and not-at-cell-edge scenario. The measurement period, T_{normal}, is any of:

- $T_{measure,NR\_Intra}$ and $T_{evaluate,NR\_Intra}$, defined in section 4.2.2.3 for intra-frequency measurements on NR cells,
- $T_{measure,NR\_Inter}$ and$T_{evaluate,NR_Inter}$ defined in section 4.2.2.4 for inter-frequency measurements on NR cells and
- $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ defined in sections 4.2.2.5 for inter-RAT E-UTRAN measurements.

When switching from low mobility scenario or not-at-cell-edge scenario or low mobility and not-at-cell-edge scenario to normal mode during cell-reselection period, the UE shall fulfill the requirements corresponding to normal mode upon fulfilling the switching criteria.

No requirement is defined for multiple transitions of scenarios within one measurement period.

4.2.2.9 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion

4.2.2.9.1 Introduction

This clause contains the requirements for measurements on intra-frequency NR cells when Srxlev ≤ $S_{IntraSearchP}$ or Squal ≤ $S_{IntraSearchQ}$ and when the UE is configured any of the following relaxed measurement critera:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4.9.2 in [1],
- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.2 in [1] respectively.

4.2.2.9.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- T331 timer is not running for EMR measurements on intra-frequency NR carrier and
- UE is configured with *lowMobilityEvalutation* [2] criterion and UE has fulfilled, or
- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and UE has fulfilled only the *lowMobilityEvalutation* [2] criterion.

The requirements defined in clause 4.2.2.3 apply for this clause except that:

- T_{detect,NR_Intra} as specified in Table 4.2.2.9.1-1.
- $T_{measure,NR\_Intra}$ as specified in Table 4.2.2.9.1-1.
- $T_{evaluate,NR\_Intra}$ as specified in Table 4.2.2.9.1-1.

Table 4.2.2.9.1-1: T_{detect,NR_Intra}, $T_{measure,NR\_Intra}$ and $T_{evaluate,NR\_Intra}$

DRX cycle length [s]	Scaling Factor (N1)		T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR\_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR\_Intra}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1)	1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1)	5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1)
0.64		5	17.92 x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvalutation* [2] criterion.					

4.2.2.9.3 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- T331 timer is not running for EMR measurements on intra-frequency NR carrier and
- UE is configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled, or

- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criteria and *combineRelaxedMeasCondition* [2] not configured, and UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

The requirements defined in clause 4.2.2.3 apply for this clause except that:

- T_{detect,NR_Intra} as specified in Table 4.2.2.9.3-1.
- $T_{measure,NR\_Intra}$ as specified in Table 4.2.2.9.3-1.
- $T_{evaluate,NR\_Intra}$ as specified in Table 4.2.2.9.3-1.

Table 4.2.2.9.3-1: T_{detect,NR_Intra}, $T_{measure,NR\_Intra}$ and $T_{evaluate,NR\_Intra}$

DRX cycle length [s]	Scaling Factor (N1)		T_{detect,NR_Intra} [s] (number of DRX cycles)	$T_{measure,NR\_Intra}$ [s] (number of DRX cycles)	$T_{evaluate,NR\_Intra}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x M2 x K1 (36 x N1 x M2 x K1)	1.28 x N1 x M2 x K1 (4 x N1 x M2 x K1)	5.12 x N1 x M2 x K1 (16 x N1 x M2 x K1)
0.64		5	17.92 x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. Note 2: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. Note 3: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.					

4.2.2.9.4 Measurements for UE fulfilling low mobility and not-at-cell edge criteria

This clause contains requirements for measurements on intra-frequency NR cells provided that:

- T331 timer is not running for EMR measurements on intra-frequency NR carrier, and
- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and
- has also fulfilled both criteria, and
- less than 1 hour have passed since measurements for cell reselection were last performed

In this case the UE is not required to meet T_{detect,NR_Intra}, $T_{measure,NR\_Intra}$ and $T_{evaluate,NR\_Intra}$ as defined in Table 4.2.2.3-1.

4.2.2.10 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

4.2.2.10.1 Introduction

This clause contains the requirements for measurements on inter-frequency NR cells when the UE is configured with any of following relaxed measurement criteria:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4. 9.2 in [1],
- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4. 9.1 and 5.2.4.9.2 in [1] respectively.

4.2.2.10.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- T331 timer is not running for EMR measurements on inter-frequency NR carrier, and
- UE is configured with *lowMobilityEvalutation* [2] criterion and UE has fulfilled, or
- UE is configured with both *lowMobilityEvalutation* [2] and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and
- UE has fulfilled only the *lowMobilityEvalutation* [2] criterion.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2.2.4 apply for this clause except that:

- T_{detect,NR_Inter} as specified in Table 4.2.2.10.2-1.
- $T_{measure,NR\_Inter}$ as specified in Table 4.2.2.10.2-1.
- $T_{evaluate,NR\_Inter}$ as specified in Table 4.2.2.10.2-1.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ and the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for inter-frequency layers of higher priority at least every K2*$T_{higher\_priority\_search\ seconds}$ where $T_{higher\_priority\_search}$ is described in clause 4.2.2.7 and, K2 = 60. Otherwise if the UE is not configured with *highPriorityMeasRelax* [2] then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher\_priority\_search}$ where $T_{higher\_priority\_search}$ is described in clause 4.2.2.7.

Table 4.2.2.10.2-1: T_{detect,NR_Inter}, $T_{measure,NR\_Inter}$ and $T_{evaluate,NR\_Inter}$

DRX cycle length [s]	Scaling Factor (N1)		T_{detect,NR_Inter} [s] (number of DRX cycles)	$T_{measure,NR\_Inter}$ [s] (number of DRX cycles)	$T_{evaluate,NR\_Inter}$ [s] (number of DRX cycles)
	FR1	FR2[Note1]			
0.32	1	8	11.52 x N1 x 1.5 x K1 (36 x N1 x 1.5 x K1)	1.28 x N1 x 1.5 x K1 (4 x N1 x 1.5 x K1)	5.12 x N1 x 1.5 x K1 (16 x N1 x 1.5 x K1)
0.64		5	17.92x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the low mobility.					

4.2.2.10.3 Measurements for UE fulfilling not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- T331 timer is not running for EMR measurements on inter-frequency NR carrier, and
- UE is configured with *cellEdgeEvaluation* [2] criterion, and UE has fulfilled or
- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and
- UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

When Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then te requirements defined in clause 4.2.2.4 apply for this clause except that:

- T_{detect,NR_Inter} as specified in Table 4.2.2.10.3-1.
- $T_{measure,NR\_Inter}$ as specified in Table 4.2.2.10.3-1.
- $T_{evaluate,NR\_Inter}$ as specified in Table 4.2.2.10.3-1.

When Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ and regardless of whether the UE is configured with *highPriorityMeasRelax* [2] or not, the UE shall search for inter-frequency layers of higher priority at least every $T_{higher\_priority\_search}$ where $T_{higher\_priority\_search}$ is described in clause 4.2.2.7

Table 4.2.2.10.3-1: T_{detect,NR_Inter}, $T_{measure,NR\_Inter}$ and $T_{evaluate,NR\_Inter}$

DRX cycle length [s]	Scaling Factor (N1)		T_{detect,NR_Inter} [s] (number of DRX cycles)	$T_{measure,NR\_Inter}$ [s] (number of DRX cycles)	$T_{evaluate,NR\_Inter}$ [s] (number of DRX cycles)
	FR1	FR2^Note1			
0.32	1	8	11.52 x N1 x 1.5 x K1 (36 x N1 x 1.5 x K1)	1.28 x N1 x 1.5 x K1 (4 x N1 x 1.5 x K1)	5.12 x N1 x 1.5 x K1 (16 x N1 x 1.5 x K1)
0.64		5	17.92x N1 x K1 (28 x N1 x K1)	1.28 x N1 x K1 (2 x N1 x K1)	5.12 x N1 x K1 (8 x N1 x K1)
1.28		4	32 x N1 x K1 (25 x N1 x K1)	1.28 x N1 x K1 (1 x N1 x K1)	6.4 x N1 x K1 (5 x N1 x K1)
2.56		3	58.88 x N1 x K1 (23 x N1 x K1)	2.56 x N1 x K1 (1 x N1 x K1)	7.68 x N1 x K1 (3 x N1 x K1)
Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. Note 2: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *cellEdgeEvaluation* [2] criterion.					

4.2.2.10.4 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-frequency NR cells provided that:

- T331 timer is not running for EMR measurements on inter-frequency NR carrier, and
- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and
- Has also fulfilled both criteria, and
- less than 1 hour have passed since measurements for cell reselection were last performed

In this case the UE is not required to meet T_{detect,NR_Inter}, $T_{measure,NR\_Inter}$ and $T_{evaluate,NR\_Inter}$ as defined in Table 4.2.2.4-1.

4.2.2.11 Measurements of inter-RAT E-UTRAN cells for UE configured with relaxed measurement criterion

4.2.2.11.1 Introduction

This clause contains the requirements for measurements on inter-RAT E-UTRAN cells when the UE is configured with any of following relaxed measurement critera:

- Relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1],
- Relaxed measurement criterion for UE not-at-cell edge defined in clause 5.2.4.9.2 in [1],
- Both low mobility criterion and not-at-cell edge criterion as defined in clauses 5.2.4.9.1 and 5.2.4.9.2 in [1] respectively.

4.2.2.11.2 Measurements for UE fulfilling low mobility criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- T331 timer is not running for EMR measurements on inter-RAT E-UTRAN, and
- UE is configured with *lowMobilityEvalutation* [2] criterion and UE has fulfilled, or
- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and

- UE has fulfilled only the *lowMobilityEvalutation* [2] criterion.

When Srxlev ≤ $S_{nonIntraSearchP}$ and Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2.2.5 apply for this clause except that:

- $T_{detect,EUTRAN}$ as specified in Table 4.2.2.11.2-1.
- $T_{measure,EUTRAN}$ as specified in Table 4.2.2.11.2-1.
- $T_{evaluate,EUTRAN}$ as specified in Table 4.2.2.11.2-1.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ and the UE is configured with *highPriorityMeasRelax* [2] then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every K2*$T_{higher\_priority\_search\ seconds}$ where $T_{higher\_priority\_search}$ is described in clause 4.2.2.7 and, K2 = 60. Otherwise if the UE is not configured with *highPriorityMeasRelax* [2] then the UE shall search for E-UTRA inter-RAT frequency layers of higher priority at least every $T_{higher\_priority\_search}$ where $T_{higher\_priority\_search}$ is described in clause 4.2.2.7.

Table 4.2.2.11.2-1: $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$, and $T_{evaluate,EUTRAN}$

DRX cycle length [s]	$T_{detect,EUTRAN}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN}$ [s] (number of DRX cycles)
0.32	11.52 x K1 (36 x K1)	1.28 x K1 (4 x K1)	5.12 x K1 (16 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 (1 x K1)	7.68 x K1 (3 x K1)
Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvalutation* [2] criterion.			

4.2.2.11.3 Measurements for UE fulfilling with not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- T331 timer is not running for EMR measurements on inter-RAT E-UTRAN, and
- UE is configured with *cellEdgeEvaluation* [2] criterion and UE has fulfilled, or
- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion and *combineRelaxedMeasCondition* [2] not configured, and
- UE has fulfilled only the *cellEdgeEvaluation* [2] criterion.

When Srxlev ≤ $S_{nonIntraSearchP}$ and Squal ≤ $S_{nonIntraSearchQ}$ then the requirements defined in clause 4.2.2.5 apply for this clause except that:

- $T_{detect,EUTRAN}$ as specified in Table 4.2.2.11.3-1.
- $T_{measure,EUTRAN}$ as specified in Table 4.2.2.11.3-1.
- $T_{evaluate,EUTRAN}$ as specified in Table 4.2.2.11.3-1.

When Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ and regardless of whether the UE is configured with *highPriorityMeasRelax* [2] or not, the UE shall search for inter-RAT E-UTRAN frequency layers of higher priority at least every $T_{higher_priority}$_search where $T_{higher\_priority\_search}$ is described in clause 4.2.2.7.

Table 4.2.2.11.3-1: $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$, and $T_{evaluate,EUTRAN}$

DRX cycle length [s]	$T_{detect,EUTRAN}$ [s] (number of DRX cycles)	$T_{measure,EUTRAN}$ [s] (number of DRX cycles)	$T_{evaluate,EUTRAN}$ [s] (number of DRX cycles)
0.32	11.52 x K1 (36 x K1)	1.28 x K1 (4 x K1)	5.12 x K1 (16 x K1)
0.64	17.92 x K1 (28 x K1)	1.28 x K1 (2 x K1)	5.12 x K1 (8 x K1)
1.28	32 x K1 (25 x K1)	1.28 x K1 (1 x K1)	6.4 x K1 (5 x K1)
2.56	58.88 x K1 (23 x K1)	2.56 x K1 (1 x K1)	7.68 x K1 (3 x K1)
Note 1: K1 = 3 is the measurement relaxation factor applicable for UE fulfilling the *lowMobilityEvalutation* [2] criterion.			

4.2.2.11.4 Measurements for UE fulfilling low mobility and not-at-cell edge criterion

This clause contains requirements for measurements on inter-RAT E-UTRAN cells provided that:

- T331 timer is not running for EMR measurements on inter-RAT E-UTRAN, and
- UE is configured with both *lowMobilityEvalutation* [2] criterion and *cellEdgeEvaluation* [2] criterion, and
- has also fulfilled both criteria, and
- less than 1 hour have passed since measurements for cell reselection were last performed,

In this case the UE is not required to meet $T_{detect,EUTRAN}$, $T_{measure,EUTRAN}$ and $T_{evaluate,EUTRAN}$ as defined in Table 4.2.2.5-1.

4.2A Cell Re-selection when subject to CCA

4.2A.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it. The requirements in clauses 4.2A.2.3, 4.2A.2.4, and 4.2A.2.6, apply when at least the target cell is on a carrier frequency subject to CCA, and the requirements in clauses 4.2A.2.2, and 4.2A.2.5 apply when at least the camping cell is on a carrier frequency subject to CCA.

When the UE is in either *Camped Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS 38.304, allowing the UE to limit its measurement activity.

In the requirements of clause 4.2A, the exceptions for side conditions apply as follows:

- for the UE capable of CA, the applicable exceptions for side conditions are specified in Annex B, clause B.x.y for UE supporting CA in FR1.

In the requirements of clause 4.2A.2, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SS/PBCH block index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding detection, measurement, or evaluation period; otherwise the SMTC occasion is considered as available at the UE.

4.2A.2 Requirements

4.2A.2.1 UE measurement capability

For idle mode cell re-selection purposes, the UE shall be capable of monitoring at least:

- Intra-frequency carrier, and
- Depending on UE capability, 7 NR inter-frequency carriers, and
- Depending on UE capability, 7 FDD E-UTRA inter-RAT carriers, and
- Depending on UE capability, 7 TDD E-UTRA inter-RAT carriers.

In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC_IDLE state shall be capable of monitoring a total of at least 14 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers. The inter-frequency carriers include carriers on unlicensed band and/or licensed band.

4.2A.2.2 Measurement and evaluation when subject to CCA on the serving cell

The UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every $(1+M_n)$*M1* DRX cycles in N_{serv_CCA} consecutive DRX cycles; where:

M1=2 if SMTC periodicity (T_{SMTC}) > 20 ms and DRX cycle ≤ 0.64 second,

otherwise M1=1.

M_n is the maximum separation in DRX cycles between two measurements that are used for filtering.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2 but not separated in time by more than M_n, where M_n=[2].

If the UE has evaluated according to Table 4.2A.2.2-1 in N_{serv_CCA} consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

UE shall initiate measurements on neighbour cells indicated by the serving cell if it is unable to measure on the serving cell for at least M_p consecutive number of DRX cycles each with at least one SMTC occasion not available at the UE, where M_p=[4] when DRX cycle length <1.28 s, M_p=[2] when DRX cycle length ≥1.28 s.

UE shall initiate the measurements on neighbour cells of any intra-frequency or inter-frequency if it is unable to measure on serving cell during at least consecutive M_q number of DRX cycles each with at least one SMTC occasion not available at the UE, regardless of any condition of $S_{nonIntraSearchP}$ and $S_{nonIntraSearchQ}$, where M_q=[8] when DRX cycle length <1.28 s, M_q=[4] when DRX cycle length ≥1.28 s.

If the UE in RRC_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information for 10 s, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1].

Table 4.2A.2.2-1: N_{serv_CCA}

DRX cycle length [s]	N_{serv_CCA} [number of DRX cycles]
0.32	M1*4+M1*Ms
0.64	M1*4+M1*Ms
1.28	2+Ms
2.56	2+Ms
Note 1: Ms is the number of DRX cycles each with at least one SMTC occasion not available at the UE during N_{serv_CCA}, and Ms< Ms,max Note2: Ms,max=[8] for DRX cycle length < 1.28 s, Ms,max= [4] for DRX cycle length ⩾ 1.28 s.	

The UE shall restart the measurements used for serving cell evaluation if Ms exceeds Ms,max.

4.2A.2.3 Measurements of intra-frequency NR cells when subject to CCA on the serving cell and target cell

The UE shall be able to identify new intra-frequency cells with CCA and perform SS-RSRP and SS-RSRQ measurements of the identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS38.304 within T_{detect,NR_Intra_CCA} when that $T_{reselection}= 0$. An intra frequency cell is considered to be detectable according to the conditions defined in Annex B.x.y for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every $T_{measure,NR\_Intra\_CCA}$ (see table 4.2A.2.3-1) for intra-frequency cells that are identified and measured according to the measurement rules. For a cell that is already identified, after 2unsuccessful measurement attempts due to exceeding the maximum number of SMTC occasions not available at the UE, the UE shall detect cells on any of the configured serving- and/or non-serving carriers.

The UE shall filter SS-RSRP and SS-RSRQ measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR\_Intra\_CCA}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within $T_{evaluate,NR\_Intra\_CCA}$ when $T_{reselection} = 0$ as specified in table 4.2A.2.3-1 provided that:

when *rangeToBestCell* is not configured:

- the cell is at least 3dB better ranked in FR1.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.
    - if there are multiple such cells, the cell has the highest rank among them.
        - the cell is at least 3dB better ranked in FR1 if the current serving cell is among them.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If $T_{reselection}$ timer has a non-zero value and the intra-frequency cell is satisfied with the reselection criteria, which are defined in TS38.304 [1], the UE shall evaluate this intra-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

Table 4.2A.2.3-1: T_{detect,NR_Intra_CCA}, $T_{measure,NR\_Intra\_CCA}$ and $T_{evaluate,NR\_Intra\_CCA}$

DRX cycle length [s]	T_{detect,NR_Intra_CCA} [s] (number of DRX cycles)	$T_{measure,NR\_Intra\_CCA}$ [s] (number of DRX cycles)	$T_{evaluate,NR\_Intra\_CCA}$ [s] (number of DRX cycles)
0.32	0.32x([36]+Md)xM2 {([36]+Md)xM2}	0.32x([4]+Mm) xM2 {([4]+Mm)xM2}	0.32x([16]+Me) x M2 {([16]+Me)xM2}
0.64	0.64x([28]+Md) {[28]+Md}	0.64x([2]+Mm) {[2]+Mm}	0.64x([8]+Me) {[8]+Me}
1.28	1.28x([25]+Md) {[25]+Md}	1.28x([1]+Mm) {[1]+Mm}	1.28x([5]+Me) {[5]+Me}
2.56	2.56x([23]+Md) {[23]+Md}	2.56x([1]+Mm) {[1]+Mm}	2.56x([3]+Me) {[3]+Me}
Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. Note 2: Md, Mm, Me are the number of DRX cycles each with at least one SMTC occasion not available during the T_{detect,NR_Intra_CCA}, $T_{measure,NR\_Intra\_CCA}$ and $T_{evaluate,NR\_Intra\_CCA}$, and Mm ≤ Mm,max, Md ≤ Md,max and Me ≤ Me,max Note 3: Mm,max = [16] for DRX cycle length = 0.32s; Mm,max = [8] for DRX cycle length = 0.64s; Mm,max = [4] for DRX cycle length = 1.28s; Mm,max = [4] for DRX cycle length = 2.56s. Note 4: Md,max=[4]*Mm,max, Me,max=[2]*Mm,max.			

The UE shall restart the measurements upon exceeding Mm,max, Md.max, or Me,max.

4.2A.2.4 Measurements of inter-frequency NR cells when subject to CCA on the target cell

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP or SS-RSRQ measurements of identified inter-frequency cells if carrier frequency information is provided by the serving cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ then the UE shall search for inter-frequency layers of higher priority at least every $T_{higher\_priority\_search}$ where $T_{higher\_priority\_search}$ is described in clause 4.2A.2.7.

If Srxlev ≤ $S_{nonIntraSearchP}$ or Squal ≤ $S_{nonIntraSearchQ}$ then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS38.304 within $K_{carrier} * T_{detect,NR\_Inter} + K_{carrier\_CCA} * T_{detect,NR\_Inter\_CCA}$ if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when $T_{reselection}$ = 0 provided that the reselection criteria is met by a margin of at least 5 dB in FR1 for reselections based on ranking or 6dB in FR1 for SS-RSRP reselections based on absolute priorities or 4dB in FR1 for SS-RSRQ reselections based on absolute priorities. The parameter $K_{carrier}$ is the number of NR inter-frequency carriers on licensed band and $K_{carrier\_CCA}$ is the number of NR inter-frequency carriers on unlicensed band indicated by the serving cell. An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.x.y for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every $T_{measure,NR\_Inter\_CCA}$. If after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every $K_{carrier} * T_{measure,NR\_Inter} + K_{carrier\_CCA} * T_{measure,NR\_Inter\_CCA}$ for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

For a cell that is already identified, after [2] unsuccessful measurement attempts due to exceeding the maximum number of SMTC occasions not available at the UE, the UE shall detect cells on any of the configured serving- and/or non-serving carriers.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least $T_{measure,NR\_Inter\_CCA}/2$.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 38.304 within $K_{carrier} * T_{evaluate,NR\_Inter} + K_{carrier\_CCA} * T_{evaluate,NR\_Inter\_CCA}$ when $T_{reselection} = 0$ as specified in table 4.2A.2.4-1 provided that the reselection criteria is met by

- the condition when performing equal priority reselection and

  when *rangeToBestCell* is not configured:

  - the cell is at least 5dB better ranked in FR1 or.

  when *rangeToBestCell* is configured:

  - the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

    - if there are multiple such cells, the cell has the highest rank among them

    - the cell is at least 5dB better ranked in FR1 if the current serving cell is among them. or

- 6dB in FR1 for SS-RSRP reselections based on absolute priorities or

- 4dB in FR1 for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If $T_{reselection}$ timer has a non zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the $T_{reselection}$ time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in Table 4.2A.2.4-1 under the following conditions:

- $T_{SMTC\_intra} = T_{SMTC\_inter} = 160$ ms; where T_{SMTC_intra} and T_{SMTC_inter} are periodicities of the SMTC occasions configured for the intra-frequency carrier and the inter-frequency carrier respectively, and

- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and

- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion [1].

Table 4.2A.2.4-1: T_{detect,NR_Inter_CCA}, $T_{measure,NR\_Inter\_CCA}$ and $T_{evaluate,NR\_Inter\_CCA}$

DRX cycle length [s]	T_{detect,NR_Inter_CCA} [s] (number of DRX cycles)	$T_{measure,NR\_Inter\_CCA}$ [s] (number of DRX cycles)	$T_{evaluate,NR\_Inter\_CCA}$ [s] (number of DRX cycles)
0.32	0.32x([36]+Md)xM2 {([36]+Md)xM2}	0.32x([4]+Mm) xM2 {([4]+Mm)xM2}	0.32x([16]+Me) x M2 {([16]+Me)xM2}
0.64	0.64x([28]+Md) {[28]+Md}	0.64x([2]+Mm) {[2]+Mm}	0.64x([8]+Me) {[8]+Me}
1.28	1.28x([25]+Md) {[25]+Md}	1.28x([1]+Mm) {[1]+Mm}	1.28x([5]+Me) {[5]+Me}
2.56	2.56x([23]+Md) {[23]+Md}	2.56x([1]+Mm) {[1]+Mm}	2.56x([3]+Me) {[3]+Me}
Note 1: M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms; otherwise M2=1. Note 2: Md, Mm, Me are the number of DRX cycles each with at least one SMTC occasion not available at the UE during T_{detect,NR_Inter_CCA}, $T_{measure,NR\_Inter\_CCA}$ and $T_{evaluate,NR\_Inter\_CCA}$, and Mm ≤ Mm,max, Md ≤ Md,max and Me ≤ Me,max Note 3: Mm,max = [16] for DRX cycle length = 0.32s; Mm,max = [8] for DRX cycle length = 0.64s; Mm,max = [4] for DRX cycle length = 1.28s; Mm,max = [4] for DRX cycle length = 2.56s. Note 4: Md,max=[4]*Mm,max, Me,max=[2]*Mm,max.			

The UE shall restart the measurements upon exceeding Mm,max, Md.max, or Me,max.

4.2A.2.5 Measurements of inter-RAT E-UTRAN cells when subject to CCA on the serving cell

The requirements in clause 4.2.2.5 shall apply.

4.2A.2.6 Maximum interruption in paging reception when subject to CCA on the target cell

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed $T_{SI,CCA} + 2*T_{target\_cell\_SMTC\_period}$.

At inter-RAT cell re-selection, the UE shall monitor the downlink of serving cell for paging reception until the UE is capable to start monitoring downlink channels for paging reception of the target inter-RAT cell. For NR to E-UTRAN cell re-selection the interruption time shall not exceed $T_{SI-EUTRA}$ + 55 ms.

T_{SI_CCA} is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for an NR cell.

$T_{SI-EUTRA}$ is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [16] for an E-UTRAN cell.

These requirements assume sufficient radio conditions, so that decoding of system information can be made without errors and does not take into account cell re-selection failure.

4.2A.2.7 General requirements

The requirements in clause 4.2.2.7 shall apply.

4.3 Minimization of Drive Tests (MDT)

4.3.1 Introduction

UE supporting minimisation of drive tests in RRC_IDLE shall be capable of:

- logging measurements in RRC_IDLE, reporting the logged measurements and meeting requirements in clause 4.3;
- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 4.3;
- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 4.3.

The logged MDT requirements consist of measurement requirements as specified in clause 4.3.2 and relative time stamp accuracy requirements as specified in clause 4.3.3. Both sets of requirements are applicable for intra-frequency, inter-frequency and inter-RAT cases in RRC_IDLE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC_IDLE state specified in clause 4.3.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 4.3.4.

4.3.2 Measurement Requirements

The requirements specified in this clause apply for the following measurements performed and logged by the UE for MDT in RRC_IDLE:

- inter-RAT E-UTRA FDD and TDD RSRP,
- inter-RAT E-UTRA FDD and TDD RSRQ,
- SS-RSRP per cell,
- SS-RSRQ per cell,
- SS-RSRP per SSB index of the serving cell,
- SS-RSRQ per SSB index of the serving cell,
- best SSB index of the serving cell,
- the number of SSBs with different SSB index which are above the threshold *absThreshSS-BlocksConsolidation* for all detected cells whose cell-ranking criterion R value is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

The requirements apply for the measurements included in logged MDT reports and RRC connection establishment failure reports.

The measurement values that are used to meet

- serving cell and reselection requirements as specified in clauses 4.2.2.2–4.2.2.7

shall also apply to values logged for MDT measurements in RRC_IDLE state.

4.3.3 Requirements for Relative Time Stamp Accuracy

The relative time stamp for a logged measurement is defined as the time from the moment the MDT configuration was received at the UE until the measurement was logged, see TS 38.331 [2].

The accuracy of the relative time stamping is such that the drift of the time stamping shall be not more than ± 2 seconds per hour.

4.3.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

Relative time stamp for RRC connection establishment failure log reporting is defined as the time elapsed from the last RRC connection establishment failure to the time when the log is included in the report TS 38.331 [2]. The UE shall report the RRC connection establishment failure log, while meeting the accuracy requirement specified in this clause.

The accuracy of the relative time stamping for RRC connection establishment failure log reporting is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. The relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RRC connection establishment failure had been detected and until the log is time-stamped.

4.3.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The UE shall report the radio link and handover failure log, while meeting the accuracy requirements specified in this clause.

Relative time stamp accuracy requirements for *timeSinceFailure* reported for MDT in a radio link failure or handover failure log are specified in this clause. *timeSinceFailure* determines the time elapsed from the last radio link failure or handover failure in NR to the time when the log is included in the report TS 38.331 [2].

The accuracy of the relative time stamping for *timeSinceFailure* is such that the drift of the time stamping shall not be larger than ± 0.72 seconds per hour and ± 10 seconds over 48 hours. These relative time stamp accuracy requirements shall apply provided that:

- no power off or detach occurs after the RLF or handover failure had been detected and until the log is time-stamped.

4.4 Idle Mode CA/DC Measurements

4.4.1 Introduction

A UE supporting *IdleInactiveMeasurements-r16* or *idleInactiveEUTRA-MeasReport-r16* shall perform the idle mode measurement on the inter-frequency CA and DC candidate frequencies/cells and E-UTRAN inter-RAT DC candidate frequencies/cells indicated by higher layers and meet the requirement specified in this clause. The UE shall perform idle mode measurements provided that the serving cell support early measurement and is within the validity area. The idle mode measurement requirements apply to a configured carrier frequency the carrier frequency and the serving cell are among the supported band combination of the UE.

4.4.2 Measurement Requirements

For a UE which supports *IdleInactiveMeasurements-r16* or *idleInactiveEUTRA-MeasReport-r16* the UE shall support the idle mode CA measurements on the serving cell, and carriers configured for idle mode CA/DC measurement reporting provided T331 has not expired, the serving cell is supporting idle mode CA/DC measurement reporting and the serving cell is in the validity area.

4.4.2.1 Detected cell requirement during state transition and Idle mode

This subclause defines the requirements for the detected cell status for the idle mode CA/DC measurement when UE transitions from RRC Connected mode to Idle mode and after UE has entered Idle mode. The requirements are applicable to an NE-DC and NR carrier aggregation capable UE which has been configured with one or more of following, one or more SCells, one E-UTRAN PSCell or one or more downlink E-UTRAN SCells during the Connected mode and which supports *IdleInactiveMeasurements-r16* or *idleInactiveEUTRA-MeasReport-r16*. The requirements are applicable for SCell(s) and E-UTRAN FDD and TDD PSCell and SCells.

Upon releasing the connection and if the UE has been configured with idle mode CA measurement reporting, following requirements apply concerning the detected cells in Connected mode upon state transitioning to Idle mode and during Idle mode:

- A cell which is detected cell in Connected mode prior to connection release, shall remain detected after UE has entered Idle mode and during Idle mode, provided that the following conditions are met:
    - The UE has been provided with a list of cells and/or carrier frequencies for early measurement reporting by dedicated RRC signaling and
    - The detected cell is among the list of cells or on a carrier frequency provided for early measurement reporting, and
    - The UE is provided with a valid timer T331 by dedicated RRC signaling, and
    - The detected cell and SSBs remains detectable until UE reconnect to the network and transmits the early measurement report, and
    - The carrier frequency of the detected cell and the carrier frequency of the serving cell are among the supported band combination of the UE.

An inter-RAT E-UTRAN cell is considered detectable according to RSRP, RSRP Ês/Iot, SCH_RP and SCH Ês/Iot defined in Annex B.1.1 and Annex B.1.2 in [15] for a corresponding Band. An inter-frequency cell is considered detectable according to the conditions in Annex B.1.2 and B.1.3 for a corresponding band. An SSB of an inter-frequency cell is considered detectable according to SSB_RP and SSB Ês/Iot defined in Annex B.1.2 and B.1.3 for a corresponding Band.

4.4.2.2 Measurements of inter-frequency CA/DC candidate cells

While T331 is running, the UE shall perform measurement on the configured inter-frequency carriers for idle mode CA measurement reporting according to the UE measurement capability.

A UE which supports *IdleInactiveMeasurements-r16* shall support idle mode CA/DC measurements of:

- at least 7 inter-frequency carriers which are also configured for inter-frequency mobility measurements, and
- at least 7 inter-frequency carriers which are not configured for inter-frequency mobility measurements.

The UE shall be capable of monitoring a total of at least 7 inter-frequency carriers for idle mode CA/DC measurements comprising of carriers configured for inter-frequency mobility measurements and carriers not configured for inter-frequency mobility measurements.

For inter-frequency carriers configured for idle mode CA/DC measurements, if Srxlev $\leqslant S_{nonIntraSearchP}$ and Squal $\leqslant S_{nonIntraSearchQ}$ the inter-frequency measurement requirements in clause 4.2.2.4 shall apply, where UE shall search for and measure inter-frequency layers configured for idle mode CA/DC measurements in preparation for possible reporting. If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ the UE shall search for inter-frequency layers configured for idle mode CA/DC measurements at least every $T_{higher\_priority\_search}$ where $T_{higher\_priority\_search}$ is described in clause 4.2.2.7, where UE shall search for and measure inter-frequency layers configured for idle mode CA/DC measurements in preparation for possible reporting.

For UE supporting *idleInactiveNR-MeasBeamReport-r16*, if the UE is configured with *beamMeasConfigIdle-r16* for idle mode CA/DC measurement, the UE shall be capable of performing SS-RSRP, SS-RSRQ for at least

- 7 SSBs with different SSB index and/or PCI on an inter-frequency layer in FR1,
- 10 SSBs with different SSB index and/or PCI on an inter-frequency layer in FR2.

If the UE is configured with *beamMeasConfigIdle-r16* for idle mode DC measurement, the UE shall be able to acquire the SSB index for a newly detectable inter-RAT NR cell and perform RSRP/RSRQ measurement within the requirements defined in clause 4.2.2.4 plus $T_{SSB\_index,NR}$, where $T_{SSB\_index,NR}$ is the additional time period used to acquire the index of the SSB being measured as defined in table 4.4.2.2-1.

Table 4.4.2.2-1: T_{SSB_index,NR_Inter}

DRX cycle length [s]	Scaling Factor (N1)		T_{SSB_index,NR_Inter} [s] (number of DRX cycles)
	FR1	FR2[Note1]	
0.32	1	8	N2 x 1.28 x N1 x 1.5 (N2 x 4 x N1 x 1.5)
0.64		5	N2 x 1.28 x N1 (N2 x 2 x N1)
1.28		4	N2 x 1.28 x N1 (N2 x 1 x N1)
2.56		3	N2 x 2.56 x N1 (N2 x 1 x N1)
Note 1: Applies for UE supporting power class 2&3&4. For UE supporting power class 1, N1 = 8 for all DRX cycle length. NOTE 2: N2 = 3 if the NR inter-frequency carrier for idle mode CA/DC measurement reporting is in FR1, and N2=[3, 5] if the NR inter-frequency carrier for idle mode CA/DC measurement reporting is in FR2.			

In the absence or expiration of T331, it is up to UE implementation to perform the idle mode DC measurement.

For inter-frequency carriers configured for idle mode CA/DC measurements, the UE shall be capable of performing SS-RSRP and SS-RSRQ measurements of the carriers, and the UE physical layer shall be capable of reporting SS-RSRP and SS-RSRQ measurements of the carriers configured for idle mode CA/DC measurements to higher layers, with measurement accuracy as specified in clauses [38.133] and [38.133], respectively.

The UE shall be able to report idle mode CA measurements when idle mode CA measurement reporting is requested by the network.

4.4.2.3 Measurements on serving cell

The UE shall measure the RSRP and RSRQ level of the serving cell and evaluate the cell selection criterion S defined in clause 4.2.2.2 and the UE physical layer shall be capable of reporting RSRP and RSRQ measurements of the serving cell to higher layers, with measurement accuracy as specified in [38.133]

4.4.2.4 Measurements of E-UTRAN inter-RAT DC candidate cells

While T331 is running, the UE shall perform measurement on the configured inter-RAT carriers for idle mode CA/DC measurement reporting according to the UE measurement capability.

A UE which supports *idleInactiveEUTRA-MeasReport-r16* shall support idle mode DC measurements of:

- at least 7 E-UTRAN inter-RAT carriers which are also configured for inter-frequency mobility measurements, and
- at least 1 E-UTRAN inter-RAT carrier which is not configured for inter-frequency mobility measurements.

The UE shall be capable of monitoring a total of at least 7 inter-RAT carriers for idle mode CA/DC measurements comprising of carriers configured for inter-frequency mobility measurements and carriers not configured for inter-frequency mobility measurements.

For inter-RAT carriers configured for idle mode CA/DC measurements, if Srxlev $\leqslant S_{nonIntraSearchP}$ and Squal $\leqslant S_{nonIntraSearchQ}$ the inter-RAT measurement requirements in clause 4.2.2.5 shall apply, where UE shall search for and measure inter-RAT layers configured for idle mode CA/DC measurements in preparation for possible reporting. If Srxlev > $S_{nonIntraSearchP}$ and Squal > $S_{nonIntraSearchQ}$ the UE shall search for inter-RAT layers configured for idle mode CA/DC measurements at least every $T_{higher\_priority\_search}$ where $T_{higher\_priority\_search}$ is described in clause 4.2.2, where UE shall search for and measure inter-RAT layers configured for idle mode CA/DC measurements in preparation for possible reporting.

For overlapping inter-RAT carriers configured for idle mode CA/DC measurements, the UE shall be capable of performing RSRP and RSRQ measurements of the carriers, and the UE physical layer shall be capable of reporting

RSRP and RSRQ measurements of the carriers configured for idle mode CA/DC measurements to higher layers, with measurement accuracy as specified in clauses in [36.133] and [36.133], respectively.

The UE shall be able to report idle mode CA measurements when idle mode CA measurement reporting is requested by the network.

5 SA: RRC_INACTIVE state mobility

5.1 Cell Re-selection

5.1.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS38.304 [1], allowing the UE to limit its measurement activity.

5.1.2 Requirements

5.1.2.1 UE measurement capability

The requirements in clause 4.2.2.1 shall apply.

5.1.2.2 Measurement and evaluation of serving cell

The requirements in clause 4.2.2.2 shall apply.

5.1.2.3 Measurements of intra-frequency NR cells

The requirements in clause 4.2.2.3 shall apply. The requirements in clause 4.2.2.9 apply for UE configured with relaxed measurement criterion.

5.1.2.4 Measurements of inter-frequency NR cells

The requirements in clause 4.2.2.4 shall apply regardless of whether the serving cell is subject to CCA or not. The requirements in clause 4.2.2.10 shall apply regardless of whether the serving cell is subject to CCA or not for UE configured with relaxed measurement criterion.

5.1.2.5 Measurements of inter-RAT E-UTRAN cells

The requirements in clause 4.2.2.5 shall apply. The requirements in clause 4.2.2.11 shall apply for UE configured with relaxed measurement criterion.

5.1.2.6 Maximum interruption in paging reception

The requirements in clause 4.2.2.6 shall apply.

5.1.2.7 General requirements

The requirements in clause 4.2.2.7 shall apply.

5.1A Cell Re-selection with CCA

5.1A.1 Introduction

The cell reselection procedure allows the UE to select a more suitable cell and camp on it. The requirements in subclauses 5.1A.2.3, 5.1A.2.4, and 5.1A.2.6 apply when at least the target cell is on a carrier frequency with CCA, and the requirements in subclauses 5.1A.2.2 and 5.1A.2.5 apply when at least the camping cell is on a carrier frequency with CCA.

When the UE is in *Camped Normally* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency, inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency and inter-frequency cells the serving cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS38.304, allowing the UE to limit its measurement activity.

5.1A.2 Requirements

5.1A.2.1 UE measurement capability

The requirements in clause 4.2A.2.1 shall apply.

5.1A.2.2 Measurement and evaluation when CCA is used on the serving cell

The requirements in clause 4.2A.2.2 shall apply.

5.1A.2.3 Measurements of intra-frequency NR cells when CCA is used on the serving cell and target cell

The requirements in clause 4.2A.2.3 shall apply.

5.1A.2.4 Measurements of inter-frequency NR cells when CCA is used on the target cell

The requirements in clause 4.2A.2.4 shall apply.

5.1A.2.5 Measurements of inter-RAT E-UTRAN cells when CCA is used on the serving cell

The requirements in clause 4.2.2.5 shall apply.

5.1A.2.6 Maximum interruption in paging reception when CCA is used on the target cell

The requirements in clause 4.2A.2.6 shall apply.

5.1A.2.7 General requirements

The requirements in clause 4.2.2.7 shall apply.

5.2 Void

5.3 Minimization of Drive Tests (MDT)

5.3.1 Introduction

UE supporting minimisation of drive tests in RRC_INACTIVE shall be capable of:

- logging measurements in RRC_INACTIVE, reporting the logged measurements and meeting requirements in clause 5.3.1;

- logging of RRC connection establishment failure, reporting the logged failure and meeting requirements in clause 5.3.1;

- logging of radio link failure and handover failure, reporting the logged failure and meeting requirements in clause 5.3.1.

The logged MDT requirements consist of measurement requirements as specified in clause 5.3.2 and relative time stamp accuracy requirements as specified in clause 5.3.3. Both sets of requirements are applicable for intra-frequency, inter-frequency and inter-RAT cases in RRC_INACTIVE state. The MDT procedures are described in TS 37.320 [31].

For RRC connection establishment failure logging and reporting, the MDT requirements consist of requirements for measurements performed and logged in RRC_INACTIVE state specified in clause 5.3.2 and relative time stamp accuracy requirement for RRC connection establishment failure log reporting as specified in clause 5.3.4.

5.3.2 Measurement Requirements

The measurements and measurement requirements applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.2.

5.3.3 Requirements for Relative Time Stamp Accuracy

The requirements for relative time stamp accuracy applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.3.

5.3.4 Requirements for Relative Time Stamp Accuracy for RRC Connection Establishment Failure Log Reporting

The requirements for relative time stamp accuracy for RRC connection establishment failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.4.

5.3.5 Requirements for Relative Time Stamp Accuracy for Radio Link Failure and Handover Failure Log Reporting

The requirements for relative time stamp accuracy for RRC link failure and handover failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.5.

5.3.6 Requirements for Relative Time Stamp Accuracy for RRC Resume Failure Log Reporting

The requirements for relative time stamp accuracy for RRC resume failure applicable for MDT in RRC_INACTIVE are the same as specified for MDT in RRC_IDLE in clause 4.3.4.

5.4 Idle Mode CA/DC Measurements

5.4.1 Introduction

A UE supporting *IdleInactiveMeasurements-r16* or *idleInactiveEUTRA-MeasReport-r16* shall perform the idle mode measurement on the inter-frequency CA and DC candidate frequencies/cells and inter-RAT DC candidate frequencies/cells indicated by higher layers and meet the requirement specified in this clause. The UE shall perform idle mode measurements provided that the serving cell support early measurement and is within the validity area. The idle mode measurement requirements apply to a configured carrier frequency the carrier frequency and the serving cell are among the supported band combination of the UE.

5.4.2 Measurement Requirements

The requiremens in clause 4.4.2 shall apply.

5.4.2.1 Detected cell requirement during state transition and Idle mode

The requiremens in clause 4.4.2.1 shall apply.

5.4.2.2 Measurements of inter-frequency CA/DC candidate cells

The requiremens in clause 4.4.2.2 shall apply.

5.4.2.3 Measurements on serving cell

The requiremens in clause 4.4.2.3 shall apply.

6 RRC_CONNECTED state mobility

6.1 Handover

6.1.1 NR Handover

6.1.1.1 Introduction

The purpose of NR handover is to change the NR PCell to another NR cell. The requirements in this clause are applicable to SA NR, NE-DC and NR-DC.

6.1.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell, and to inter-frequency handover from NR FR1 cell in a carrier frequency with CCA to NR FR1 cell.

6.1.1.2.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ msec from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.2.2.

6.1.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot$\geqslant$-2 dB, then $T_{search} = T_{rs}$ ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot$\geqslant$-2 dB, then $T_{search} = 3 * T_{rs}$ ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2.5 for intra-frequency handover and Clause 9.3.4 for inter-frequency handover.

6.1.1.3 NR FR2- NR FR1 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR2 cell to NR FR1 cell.

6.1.1.3.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.3.2.

6.1.1.3.2 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot $\geqslant$ -2 dB, then T_{search} = 3* T_{rs} ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 40ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2.5 for intra-frequency handover and Clause 9.3.4 for inter-frequency handover.

6.1.1.4 NR FR2- NR FR2 Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR2 cell to NR FR2 cell.

6.1.1.4.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.4.2.

6.1.1.4.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot$\geqslant$-2 dB, then T_{search} = 8* T_{rs} ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot$\geqslant$-2 dB, then T_{search} = 8*3* T_{rs} ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2ms.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. T_{Δ} = T_{rs} for both known and unknown target cell.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

In FR2, the target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the handover command:
    - the UE has sent a valid measurement report for the target cell and
    - One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.3,

- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.3.

otherwise it is unknown.

6.1.1.5 NR FR1- NR FR2 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR2 cell.

6.1.1.5.1 Handover delay

When the UE receives a RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay defined in clause 12 in TS 38.331 [2] plus the interruption time stated in clause 6.1.1.5.2.

6.1.1.5.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When in inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the handover command is received by the UE. If the target cell is a known cell, then T_{search} = 0 ms. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot$\geqslant$-2 dB, then T_{search} = 8*3* T_{rs} ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up 40ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2ms.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. T_{Δ} = T_{rs} for both known and unknown target cell.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms.

In FR2, the target cell is known if it has been meeting the following conditions:

During the last 5 seconds before the reception of the handover command:

- the UE has sent a valid measurement report for the target cell and
- One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.3,

- One of the SSBs measured from the target cell also remains detectable during the handover delay according to the cell identification conditions specified in clause 9.3.

otherwise it is unknown.

6.1.2 NR Handover to other RATs

6.1.2.1 NR – E-UTRAN Handover

6.1.2.1.1 Introduction

The purpose of inter-RAT handover from NR to E-UTRAN is to change the radio access mode of PCell from NR to E-UTRAN. The handover procedure is initiated from NR with a RRC message that implies a handover as described in TS 38.331 [2]. The requirements in this clause are applicable to SA NR, NE-DC and NR-DC, and to handover from SA NR cell in a carrier frequency with CCA to E-UTRAN.

6.1.2.1.2 Handover delay

When the UE receives a RRC message implying handover to E-UTRAN the UE shall be ready to start the transmission of the uplink PRACH channel in E-UTRA within $D_{handover}$ ms from the end of the last TTI containing the RRC command. $D_{handover}$ is defined as

$$D_{handover} = T_{RRC\_procedure\_delay} + T_{interrupt}$$

Where:

$T_{RRC\_procedure\_delay}$: it is the RRC procedure delay, which is 50ms

$T_{interrupt}$: it is the time between end of the last TTI containing the RRC command on the NR PDSCH and the time the UE starts transmission of the PRACH in E-UTRAN, excluding $T_{RRC\_procedure\_delay}$. $T_{interrupt}$ is defined in clause 6.1.2.1.3.

6.1.2.1.3 Interruption time

When the inter-RAT handover to E-UTRAN is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + 20 \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is unknown and signal quality is sufficient for successful cell detection on the first attempt, then T_{search} = 80 ms. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to 30 ms.

NOTE: The actual value of T_{IU} shall depend upon the PRACH configuration used in the target cell.

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant E-UTRAN cell identification requirements are described in clause 9.4.1.

6.1.2.2 NR – UTRAN Handover

6.1.2.2.1 Introduction

The purpose of inter-RAT handover from NR to UTRAN is to change the radio access mode from NR to UTRAN. The handover procedure is initiated from NR with a RRC message that implies a hard handover as described in TS 38.331 [2].

6.1.2.2.2 Handover delay

When the UE receives a RRC message implying handover to UTRAN the UE shall be ready to start the transmission of the new UTRA uplink DPCCH within $D_{handover}$ msfrom the end of the last NR TTI containing the RRC *MobilityfromNRCommand* command.

where:

- $D_{handover}$ equals the RRC procedure delay, which is 50 ms plus the interruption time stated in clause 6.1.2.2.3.

6.1.2.2.3 Interruption time

The interruption time is the time between the end of the last TTI containing the RRC command on the NR PDSCH and the time the UE starts transmission on the uplink DPCCH in UTRAN, excluding the RRC procedure delay. The interruption time depends on whether the target cell is known to the UE or not.

The target cell is known if it has been measured by the UE during the last 5 seconds otherwise it is unknown. The UE shall always perform a UTRA synchronisation procedure as part of the handover procedure.

If the target cell is known the interruption time shall be less than $T_{interrupt1}$

$$T_{interrupt1} = T_{IU}+T_{sync}+50+ 10*F_{max} + T_{MC} \text{ ms}$$

If the target cell is unknown the interruption time shall be less than $T_{interrupt2}$

$$T_{interrupt2} = T_{IU}+T_{sync}+150 + 10*F_{max} + T_{MC} \text{ ms}$$

This requirement shall be met, provided that there is one target cell in the *MobilityfromNRCommand* command. Performance requirements for E-UTRA to UTRA soft handover are not specified. When UE is connected to an NR cell, UTRA SFN timing measurements are not reported. This implies that the timing of the DPCH of the UTRA target cells in the active set cannot be configured by UTRAN to guarantee that all target cells fall within the UE reception window of T_0 +/- 148 chips.

Where:

- T_{IU} is the interruption uncertainty when changing the timing from the NR to the new UTRAN cell. T_{IU} can be up to one UTRA frame (10 ms).

- F_{max} denotes the maximum number of radio frames within the transmission time intervals of all transport channels that are multiplexed into the same CCTrCH on the UTRA target cell. If HS-PDSCH is configured in the UTRA target cell, F_{max} is 4 radio frames.

- T_{sync} is the time required for measuring the downlink DPCCH channel as stated in TS 25.214 [32], clause 4.3.1.2. In case higher layers indicate the usage of a post-verification period T_{sync}=0 ms. Otherwise T_{sync}=40 ms.

- T_{MC} is 0ms if a single UTRA cell is configured as the handover target, otherwise 20ms if handover to UTRA with 1, 2 or 3 UTRA carriers with secondary HS-PDSCH is configured.

The phase reference is the primary CPICH.

The requirements in this clause assume that N312 has the smallest possible value i.e. only one insync is required.

6.1.3 NR DAPS Handover

6.1.3.1 Introduction

The requirements in this clause are applicable to DAPS handover to change the NR PCell to another NR cell.

Note: requirements only apply if

- the UE indicates ‘no-gap’ via *intraFreq-needForGap* for intra-frequency measurement of source cell and intra-frequency measurement of target cell, or

- the SSB of source cell is completely contained in the active DL BWP of the source cell, and the SSB of target cell is completely contained in the active DL BWP of the target cell, or

- the initial DL and UL BWP of source cell is confined within the active DL and UL BWP of the source cell respectively, and the initial DL and UL BWP of target cell is confined within the active DL and UL BWP of the target cell respectively.

6.1.3.2 NR FR1 - NR FR1 DAPS Handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency handovers from NR FR1 cell to NR FR1 cell. A DAPS handover is intra-frequency if the centre frequency of the SSB of the source cell and the centre frequency of the SSB of the target cell are the same, and the subcarrier spacing of the two SSBs are also the same.

Note: For intra-frequency DAPS handover, no requirement applies if active DL and UL BWP of target cell is not confined within the active DL and UL BWP of the source cell respectively.

Note: For inter-frequency DAPS handover, no requirement applies if the BWP of target cell is overlaped with the BWP of source cell in frequency domain.

An FR1 DAPS handover is synchronous if it meets the conditions in table 6.1.3.2-1, otherwise it is asynchronous

Table 6.1.3.2-1: Sync conditions for FR1 DAPS handover

Type of handover	Maximum receive timing difference between source and taget cell (µs) for sync DAPS handover	Maximum transmit timing difference between source and taget cell (µs) for sync DAPS handover
Intra-frequency Note 1,2,3	6µs	7.6 µs
Intra-band inter-frequency Note 1,2,3	6µs	7.6 µs
Inter-band inter-frequency	33 µs	34.6 µs
Note 1: For synchonous DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected for the first symbol of the slot. For asynchronous DAPS handover, if the receive time difference exceeds the cyclic prefix length of that SCS, interruptions may occur depending on UE implementation. The duration and frequency of occurrence of such interruptions is not specified. Note 2: For DAPS handover on a TDD band, a UE is not expected to transmit in the uplink earlier than N_{RX-TX} after the end of the last received downlink symbol in the same cell where N_{RX-TX}=26500Tc. Note 3: For DAPS handover on a TDD band, a UE is not expected to receive in the downlink earlier than N_{TX-RX} after the end of the last transmitted uplink symbol in the same cell where N_{TX-RX}=26500Tc.		

6.1.3.2.1 DAPS handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover1}$ seconds from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

$$D_{handover1} = T_{RRC\_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

$T_{RRC\_procedure}$ is the maximum RRC procedure delay as specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.2.2.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 38.331 [2] within $D_{handover2}$.

$D_{handover2} = T_{RRC\_procedure} + T_{interrupt2}$

Where:

$T_{RRC\_procedure}$ is the RRC procedure delay as specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.2.2.

6.1.3.2.2 Interruption time

During $D_{handover1}$, the UE is allowed an interruption of up to $T_{interrupt1}$ on source cell.

For FR1-to-FR1 intra-frequency handover, $T_{interrupt1}$ is specified in Table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: $T_{interrupt1}$ for FR1-to-FR1 intra-frequency DAPS HO

μ	NR Slot length (ms)	Interruption length $T_{interrupt1}$ (slots Note 1), synchronous DAPS HO	Interruption length $T_{interrupt1}$ (slots Note 1), asynchronous DAPS HO
0	1	1	2
1	0.5	2	3
2	0.25	4	5
Note 1: The same SCS of source cell and target cell is assumed. Note 2: It is assumed that the BWP of target cell is not larger than the BWP of source cell. It is assumed that the CBW of target cell is not larger than the CBW of source cell Note 3: Void			

For FR1-to-FR1 intra-band inter-frequency handover, $T_{interrupt1}$ is specified in Table 6.1.3.2.2-2.

Table 6.1.3.2.2-2: $T_{interrupt1}$ for FR1-to-FR1 intra-band inter-frequency DAPS HO

μ	NR Slot length (ms)	$T_{interrupt1}$ (slots Note 1), synchronous DAPS HO	$T_{interrupt1}$ (slots Note 1), asynchronous DAPS HO
0	1	1 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$	2+ $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
1	0.5	2 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$	3+ $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
2	0.25	4 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$	5+ $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
Note 1: The same SCS of source cell and target cell is assumed. Note 2: $T_{SMTC\_duration}$ measured in subframes is the longest SMTC duration between source cell and target cell. Note 3: Void Note 4: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].			

For FR1-to-FR1 inter-band handover, $T_{interrupt1}$ is specified in Table 6.1.3.2.2-3.

Table 6.1.3.2.2-3: $T_{interrupt1}$ for FR1-to-FR1 inter-band DAPS HO

μ	NR Slot length (ms)	$T_{interrupt1}$ (slots)	
	of source cell	Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	5

During $D_{handover2}$, the UE is allowed an interruption of up to $T_{interrupt2}$ on target cell.

For FR1-to-FR1 intra-frequency handover, $T_{interrupt2}$ equals to 2ms when the BWP of target cell is smaller than the BWP of source cell, and $T_{interrupt2}$ is specified in Table 6.1.3.2.2-4 when the same BWP is used for target cell and source cell.

Table 6.1.3.2.2-4: $T_{interrupt2}$ for FR1-to-FR1 intra-frequency DAPS HO

μ	NR Slot length (ms)	Interruption length X (slots[Note 1])	$T_{interrupt2}$ (slots[Note 1]) for asynchronous DAPS HO
0	1	1	2
1	0.5	2	3
2	0.25	4	5
Note 1: The same SCS of source cell and target cell is assumed. Note 2: It is assumed that the BWP of target cell is the same as the BWP of source cell. Note 3: Void			

For FR1-to-FR1 intra-band inter-frequency handover, $T_{interrupt2}$ is specified in Table 6.1.3.2.2-5.

Table 6.1.3.2.2-5: $T_{interrupt2}$ for FR1-to-FR1 intra-band inter-frequency DAPS HO

μ	NR Slot length (ms)	$T_{interrupt2}$ (slots[Note 1]) for synchronous DAPS HO	$T_{interrupt2}$ (slots[Note 1]) for asynchronous DAPS HO
0	1	1 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$	2+ $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
1	0.5	2 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$	3+ $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
2	0.25	4 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$	5+ $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
Note 1: The same SCS of source cell and target cell is assumed. Note 2: $T_{SMTC\_duration}$ measured in subframes is the longest SMTC duration between source cell and target cell. Note 3: Void. Note 4: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].			

For FR1-to-FR1 inter-band handover, $T_{interrupt2}$ is specified in Table 6.1.3.2.2-6.

Table 6.1.3.2.2-6: $T_{interrupt2}$ for FR1-to-FR1 inter-band DAPS HO

μ	NR slot length (ms) of target cell	$T_{interrupt2}$ (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	5

6.1.3.3 NR FR2- NR FR1 DAPS Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR2 cell to NR FR1 cell.

An FR2-FR1 DAPS handover is synchronous if it meets the conditions in table 6.1.3.3-1, otherwise it is asynchronous

Table 6.1.3.3-1: Sync condition for FR2-FR1 DAPS handover

Frequency Range of the pair of carriers	Maximum receive timing difference between source and taget cell (μs) for sync DAPS handover	Maximum transmit timing difference between source and taget cell (μs) for sync DAPS handover
Between FR1 and FR2	25	26.1

6.1.3.3.1 DAPS handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover1}$ ms from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

$$D_{handover1} = T_{RRC\_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

$T_{RRC\_procedure}$ is the maximum RRC procedure delay as specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.3.2.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 38.331 [2] within $D_{handover2}$.

$$D_{handover2} = T_{RRC\_procedure} + T_{interrupt2}$$

Where:

$T_{RRC\_procedure}$ is the RRC procedure delay as specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.3.2.

6.1.3.3.2 Interruption time

During $D_{handover1}$, the UE is allowed an interruption of up to $T_{interrupt1}$ on source cell.

For FR2-to-FR1 inter-band handover, $T_{interrupt1}$ is specified in Table 6.1.3.3.2-1.

Table 6.1.3.3.2-1: $T_{interrupt1}$ for FR2-to-FR1 inter-band DAPS HO

μ	NR slot length (ms) of source cell	$T_{interrupt1}$ (slots)	
		Sync	Async
2	0.25	5	5
3	0.125	9	9

During $D_{handover2}$, the UE is allowed an interruption of up to $T_{interrupt2}$ on target cell.

For FR2-to-FR1 inter-band handover, $T_{interrupt2}$ is specified in Table 6.1.3.3.2-2.

Table 6.1.3.3.2-2: $T_{interrupt2}$ for FR2-to-FR1 inter-band DAPS HO

μ	NR slot length (ms) of target cell	$T_{interrupt2}$ (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	5

6.1.3.4 NR FR1- NR FR2 DAPS Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR2 cell.

An FR1-FR2 DAPS handover is synchronous if it meets the conditions in table 6.1.3.4-1, otherwise it is asynchronous

Table 6.1.3.4-1, : Sync condition for FR1-FR2 DAPS handover

Frequency Range of the pair of carriers	Maximum receive timing difference between source and taget cell (μs) for sync DAPS handover	Maximum transmit timing difference between source and taget cell (μs)Note 1 sync DAPS handover
Between FR1 and FR2	25	26.1

6.1.3.4.1 DAPS handover delay

Procedure delays for the procedure that can command a DAPS handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying handover, the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover1}$ ms from the end of the last TTI containing the RRC command when UE is configured with dual active protocol stack handover.

$$D_{handover1} = T_{RRC\_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

$T_{RRC\_procedure}$ is the maximum RRC procedure delay as specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.5.2.

After successful RACH procedure of the target cell, when the UE receives an RRC message implying source cell release command, the UE shall accomplish the release actions specified in TS 38.331 [2] within $D_{handover2}$.

$D_{handover2} = T_{RRC\_procedure} + T_{interrupt2}$

Where:

$T_{RRC\_procedure}$ is the RRC procedure delay as specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.4.2.

6.1.3.4.2 Interruption time

During $D_{handover1}$, the UE is allowed an interruption of up to $T_{interrupt1}$ on source cell.

For FR1-to-FR2 inter-band handover, $T_{interrupt1}$ is specified in Table 6.1.3.4.2-1.

Table 6.1.3.4.2-1: $T_{interrupt1}$ for FR1-to-FR2 inter-band DAPS HO

μ	NR slot length (ms) of source cell	$T_{interrupt1}$ (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	5

During $D_{handover2}$, the UE is allowed an interruption of up to $T_{interrupt2}$ on target cell.

For FR1-to-FR2 inter-band handover, $T_{interrupt2}$ is specified in Table 6.1.3.4.2-2.

Table 6.1.3.4.2-2: $T_{interrupt2}$ for FR1-to-FR2 inter-band DAPS HO

μ	NR slot length (ms) of target cell	$T_{interrupt2}$ (slots)	
		Sync	Async
2	0.25	5	5
3	0.125	9	9

6.1.4 NR Conditional Handover

6.1.4.1 Introduction

The requirements in this clause are applicable to conditional handover to change the NR PCell to another NR cell.

6.1.4.2 NR FR1 – NR FR1 conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR FR1 cell to NR FR1 cell.

6.1.4.2.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ seconds from the end of the last TTI containing the RRC command.

$$D_{CHO} = T_{RRC} + T_{Event\_DU} + T_{measure} + T_{interrupt} + T_{CHO\_execution}$$

Where:

T_{RRC} is the maximum RRC procedure delay to be defined in clause 12 in TS 38.331 [2].

T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover.

$T_{measure}$ is the measurements time stated in clause 6.1.4.2.2.

$T_{CHO\_execution}$ is the conditional execution preparation time in clause 6.1.4.2.3.

$T_{interrupt}$ is the interruption time stated in clause 6.1.4.2.4.

6.1.4.2.2 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a handover to a target cell and interruption time starts.

For intra-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify\_intra\_without\_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\_inter\_with\_index}$ or $T_{identify\_inter\_without\_index}$ defined in clause 9.3.4.

When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index}$ for intra-frequency handover or $T_{identify\_inter\_without\_index}$ for inter-frequency handover. If a cell which has been detectable at least for the time period $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index}$ for intra-frequency handover or $T_{identify\_inter\_without\_index}$ for inter-frequency handover becomes undetectable for a period and then the cell becomes detectable again and triggers a handover, the measurement time delay shall be less than $T_{SSB\_measurement\_period\_intra}$ or $T_{SSB\_measurement\_period\_inter}$ provided the timing to that cell has not changed more than ± 3200 Tc while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

6.1.4.2.3 Preparation time

$T_{CHO\_execution}$ is the UE execution preparation time for conditional handover, and starts after UE realizes the condition of CHO is met and identity of the target cell is determined. $T_{CHO\_execution}$ can be up to 10ms.

6.1.4.2.4 Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH.

For intra-frequency or inter-frequency conditional conditional handover, the measurment time shall be less than

$$T_{interrupt} = T_{processing} + T_{IU} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3]

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2ms.

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of T_{IU} shall depend upon the PRACH configuration used in the target cell.

6.1.4.3 NR FR2 – NR FR1 conditional handover

The requirements in this clause are applicable to inter-frequency conditional handover from NR FR2 cell to NR FR1 cell.

The requirements defined in clause 6.1.4.2 applies assuming inter-frequency handover and:

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 40ms.

6.1.4.4 NR FR2 – NR FR2 conditional handover

The requirements in this clause are applicable to both intra-frequency and inter-frequency conditional handover from NR FR2 cell to NR FR2 cell.

6.1.4.4.1 Handover delay

Procedure delays for all procedures that can command a conditional handover are specified in TS 38.331 [2].

When the UE receives a RRC message implying conditional handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ seconds from the end of the last TTI containing the RRC command.

$$D_{CHO} = T_{RRC} + T_{Event\_DU} + T_{measure} + T_{interrupt} + T_{CHO\_execution}$$

Where:

T_{RRC} is the maximum RRC procedure delay to be defined in clause 12 in TS 38.331 [2].

T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional handover command until a condition exists at the measurement reference point which will trigger the conditional handover.

$T_{measure}$ is the measurements time stated in clause 6.1.4.4.2.

$T_{CHO\_execution}$ is the conditional execution preparation time in clause 6.1.4.4.3. $T_{interrupt}$ is the interruption time stated in clause 6.1.4.4.4.

6.1.4.4.2 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a handover to a target cell and interruption time starts.

For intra-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify\_intra\_without\_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency handover, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\_inter\_with\_index}$ or $T_{identify\_inter\_without\_index}$ defined in clause 9.3.4.

When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index}$ for intra-frequency handover or $T_{identify\_inter\_without\_index}$ for inter-frequency handover. If a cell which has been detectable at least for the time period $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index}$ for intra-frequency handover or $T_{identify\_inter\_without\_index}$ for inter-frequency handover becomes undetectable for a period and then the cell becomes detectable again and triggers a handover, the measurement time delay shall be less than $T_{SSB\_measurement\_period\_intra}$ or $T_{SSB\_measurement\_period\_inter}$ provided the timing to that cell has not changed more than ± 3200 Tc while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

6.1.4.4.3 Preparation time

$T_{CHO\_execution}$ is the UE execution preparation time for conditional handover, and starts after UE realizes the condition of CHO is met and identity of the target cell is determined. $T_{CHO\_execution}$ can be up 10ms.

6.1.4.4.4 Interruption time

The interruption time is the time between when the UE starts to execute the conditional handover to the target cell and the time the UE starts transmission of the new PRACH.

For intra-frequency or inter-frequency conditional conditional handover, the measurment time shall be less than

$$T_{interrupt} = T_{processing} + T_{IU} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20ms.

T_{IU} is the interruption uncertainty in acquiring the first available PRACH occasion in the new cell. T_{IU} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3]

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. $T_{\Delta} = T_{rs}$.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2ms.

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cellin the handover command, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the handover command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

NOTE 1: The actual value of T_{IU} shall depend upon the PRACH configuration used in the target cell.

6.1.4.5 NR FR1 – NR FR2 conditional handover

The requirements in this clause are applicable to inter-frequency conditional handover from NR FR1 cell to NR FR2 cell.

The requirements defined in clause 6.1.4.4 applies assuming inter-frequency handover and:

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 40ms.

6.1A Void

6.1A.1 Void

6.1A.1.1 Void

6.1A.1.2 Void

6.1A.1.2.1 Void

6.1A.1.2.2 Void

6.1B Handover to target cell using CCA

6.1B.1 NR Handover

6.1B.1.1 Introduction

The purpose of NR handover to target cell using CCA is to change the NR PCell to a target NR cell in a carrier frequency with CCA. The requirements in this clause are applicable to NR SA.

In the requirements of clause 6.1B.1, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding detection or time tracking period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 6.1B.1, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE.

6.1B.1.2 NR FR1 - NR FR1 Handover

The requirements in this clause are applicable to inter-frequency handovers from NR FR1 cell to NR FR1 cell in carrier frequencies with CCA, and to both intra-frequency and inter-frequency handovers from NR FR1 cell in carrier frequencies with CCA to NR FR1 cell in carrier frequencies with CCA.

6.1B.1.2.1 Handover delay

When the UE receives an RRC message implying handover the UE shall be ready to start the transmission of the new uplink PRACH channel within $D_{handover}$ ms from the end of the last TTI containing the RRC command.

Where:

$D_{handover}$ equals the applicable RRC procedure delay to be defined in clause12 in TS 38.331 [2] plus the interruption time stated in clause 6.1B.1.2.2.

6.1B.1.2.2 Interruption time

The interruption time is the time between end of the last TTI containing the RRC command on the old PDSCH and the time the UE starts transmission of the new PRACH, excluding the RRC procedure delay.

When intra-frequency or inter-frequency handover is commanded, the interruption time shall be less than $T_{interrupt}$

$$T_{interrupt} = T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin} \text{ ms}$$

Where:

T_{search} is the time required to search the target cell when the target cell is not already known when the handover command is received by the UE. If the target cell is known, then T_{search} = 0 ms. If the target cell is an unknown intra-frequency cell and the target cell Es/Iot⩾-2 dB, then $T_{search} = (1+L_1) *T_{rs}$. If the target cell is an unknown inter-frequency cell and the target cell Es/Iot⩾-2 dB, then $T_{search} = (3+L_1') *T_{rs}$ where L_1 and L_1' are the number of SMTC occasions not available at the UE during the intra-frequency and inter-frequency detection period, respectively. Regardless of whether DRX is in use by the UE, T_{search} shall still be based on non-DRX target cell search times.

T_Δ is time for fine time tracking and acquiring full timing information of the target cell. $T_\Delta = (1+ L_2) *T_{rs}$ ms, where L_2 is the number of SMTC occasions not available at the UE during the time tracking period.

$T_{processing}$ is time for UE processing. $T_{processing}$ can be up to 20ms.

T_{margin} is time for SSB post-processing. T_{margin} can be up to 2ms.

T_{IU} is the interruption uncertainty due to the random access procedure when sending PRACH to the new cell. T_{IU} can be up to: $(1+ L_3)*T_{SSB,RO}$ + 10 ms where $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in Table 8.1-1 of TS 38.213 [3] and L_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. L_3 = 0 for Type 2C UL channel access procedure as defined in TS 37.213 [33]. When the UE is configured with both the UL BWP with PRACH occasion on the target cell and UL CCA failure detection/recovery, the interruption can be longer.

T_{rs} is the SMTC periodicity of the target NR cell in a carrier frequency with CCA if the UE has been provided with an SMTC configuration for the target cell in the handover command, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with T_{rs}=5ms assuming the SSB transmission periodicity is 5ms. There is no requirement if the SSB transmission periodicity is not 5ms.

NOTE 1: The interruption time considering the potential extensions caused by L_1, L_1', L_2, L_3 and by the UL CCA failure detection/recovery mechanism is limited by the T304 timer. The UE behaviour at the T304 timer expiry is detailed in TS 38.331 [2].

In the interruption requirement a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown. Relevant cell identification requirements are described in Clause 9.2A.5 for intra-frequency handover and Clause 9.3A.4 for inter-frequency handover to a carrier frequency with CCA.

6.2 RRC Connection Mobility Control

6.2.1 SA: RRC Re-establishment

6.2.1.1 Introduction

This clause contains requirements on the UE regarding RRC connection re-establishment procedure. RRC connection re-establishment is initiated when a UE in RRC_CONNECTED state on the carrier without CCA or on the carrier with CCA loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [2].

The requirements in this clause are applicable for RRC connection re-establishment to NR cell.

6.2.1.2 Requirements

In RRC_CONNECTED state the UE shall be capable of sending *RRCReestablishmentRequest* message within $T_{re-establish\_delay}$ seconds from the moment it detects a loss in RRC connection. The total RRC connection delay ($T_{re-establish\_delay}$) shall be less than:

$$T_{re-establish\_delay} = T_{UE\_re-establish\_delay} + T_{UL\_grant}$$

T_{UL_grant}: It is the time required to acquire and process uplink grant from the target PCell. The uplink grant is required to transmit *RRCReestablishmentRequest* message.

The UE re-establishment delay ($T_{UE\_re-establish\_delay}$) is specified in clause 6.2.1.2.1.

6.2.1.2.1 UE Re-establishment delay requirement

The UE re-establishment delay ($T_{UE\_re-establish\_delay}$) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell. The UE re-establishment delay ($T_{UE\_re-establish\_delay}$) requirement shall be less than:

$$T_{UE\_re-establish\_delay} = 50\text{ ms} + T_{identify\_intra\_NR} + \sum_{i=1}^{N_{freq}-1} T_{identify\_inter\_NR,i} + T_{SI-NR} + T_{PRACH}$$

The intra-frequency target NR cell shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clause 10.1.2 and 10.1.3 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.4 and 10.1.5 are fulfilled for a corresponding NR Band for FR1 and FR2, respectively, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band are fulfilled.

$T_{identify\_intra\_NR}$: It is the time to identify the target intra-frequency NR cell and it depends on whether the target NR cell is known cell or unknown cell and on the FR of the target NR cell. If the UE is not configured with intra-frequency NR carrier for RRC re-establishment then $T_{identify\_intra\_NR}$=0; otherwise $T_{identify\_intra\_NR}$ shall not exceed the values defined in Table 6.2.1.2.1-1.

$T_{identify\_inter\_NR,i}$: It is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* configured for RRC re-establishment and it depends on whether the target NR cell is known cell or unknown cell and on the FR of the target NR cell. $T_{identify\_inter\_NR,i}$ shall not exceed the values defined in Table 6.2.1.2.1-2.

T_{SMTC}: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*, T_{smtc} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

$T_{SMTC,i}$: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If it is not configured, the UE may assume that the target SSB periodicity is no larger than 20 ms.

T_{SI-NR}: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for the target NR cell.

$T_{PRACH:}$ It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{PRACH} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

N_{freq}: It is the total number of NR frequencies to be monitored for RRC re-establishment; N_{freq} = 1 if the target intra-frequency NR cell is known, else N_{freq} = 2 and $T_{identify\_intra\_NR}$ = 0 if the target inter-frequency NR cell is known.

There is no requirement if the target cell does not contain the UE context.

In the requirement defined in the below tables, the target FR1 cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown.

Table 6.2.1.2.1-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify\_intra\_NR}$ [ms]	
		Known NR cell	Unknown NR cell
⩾ -8	FR1	MAX (200 ms, 5 x T_{SMTC})	MAX (800 ms, 10 x T_{SMTC})
⩾ -8	FR2	N/A	MAX (1000 ms, 80 x T_{SMTC}))
< -8	FR1	N/A	800[Note1]
< -8	FR2	N/A	3520[Note1]
Note 1: The UE is not required to successfully identify a cell on any NR frequency layer when T_{SMTC} > 20 ms and serving cell SSB Ês/Iot < -8 dB.			

Table 6.2.1.2.1-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell

Serving cell SSB Ês/Iot (dB)	FR of target NR cell	$T_{identify\_inter\_NR, i}$ [ms]	
		Known NR cell	Unknown NR cell
⩾ -8	FR1	MAX (200 ms, 6 x $T_{SMTC, i}$)	MAX (800 ms, 13 x $T_{SMTC, i}$)
⩾ -8	FR2	N/A	MAX (1000 ms, 104 x $T_{SMTC, i}$))
< -8	FR1	N/A	800[Note1]
< -8	FR2	N/A	4000[Note1]
Note 1: The UE is not required to successfully identify a cell on any NR frequency layer when $T_{SMTC,i}$ > 20 ms and serving cell SSB Ês/Iot < -8 dB.			

6.2.1A RRC Re-establishment with CCA

6.2.1A.1 Introduction

This clause contains requirements on the UE regarding RRC connection re-establishment procedure on the carrier with CCA. RRC connection re-establishment on the carrier with CCA is initiated when a UE in RRC_CONNECTED state on the carrier w/o or with CCA loses RRC connection due to any of failure cases, including radio link failure, handover failure, and RRC connection reconfiguration failure. The RRC connection re-establishment procedure is specified in clause 5.3.7 of TS 38.331 [2].

In the requirements of clause 6.2.1A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding RRC re-establishment period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 6.2.1A, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE; otherwise the PRACH occasion is considered as available for transmission.

The requirements in this clause are applicable for RRC connection re-establishment to NR cell on the carrier with CCA.

6.2.1A.2 Requirements

In RRC_CONNECTED state on the carrier w/o or with CCA the UE shall be capable of sending *RRCReestablishmentRequest* message within $T_{re\text{-}establish\_delay\_CCA}$ seconds from the moment it detects a loss in RRC connection. The total RRC connection delay ($T_{re\text{-}establish\_delay\_CCA}$) shall be less than:

$$T_{re-establish\_delay\_CCA} = T_{UE\_re-establish\_delay\_CCA} + T_{UL\_grant}$$

T_{UL_grant}: It is the time required to acquire and process uplink grant from the target PCell with CCA. The uplink grant is required to transmit *RRCReestablishmentRequest* message.

The UE re-establishment delay ($T_{UE\_re\text{-}establish\_delay\_CCA}$) is specified in clause 6.2.1A.2.1.

6.2.1A.2.1 UE Re-establishment with CCA delay requirement

The UE re-establishment on the carrier with CCA delay ($T_{UE\_re-establish\_delay\_CCA}$) is the time between the moments when any of the conditions requiring RRC re-establishment on the carrier with CCA as defined in clause 5.3.7 in TS 38.331 [2] is detected by the UE and when the UE sends PRACH to the target PCell on the carrier with CCA . The UE re-establishment delay requirement ($T_{UE\_re-establish\_delay\_CCA}$) on the carrier with CCA shall be less than:

$$T_{UE\_re-establish\_delay\_CCA} = 50\text{ ms} + T_{identify\_intra\_NR\_CCA} + \sum_{i=1}^{N_{freq}-1} T_{identify\_inter\_NR\_CCA,i} + T_{SI-NR\_CCA} + T_{PRACH\_CCA}$$

The intra-frequency target NR cell with CCA shall be considered detectable if each relevant SSB can satisfy that:

- SS-RSRP related side conditions given in clause 10.1.2 are fulfilled for a corresponding NR Band for FR1, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding NR Band are fulfilled.

The inter-frequency target NR cell on the carrier with CCA shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.4 are fulfilled for a corresponding NR Band for FR1, and
- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding NR Band are fulfilled.

$T_{identify\_intra\_NR\_CCA}$: If the target intra-frequency carrier is the carrier without CCA, it is the time to identify the target intra-frequency NR cell which is defined in clause 6.2.1; otherwise it is the time to identify the target intra-frequency NR cell on the carrier with CCA and it depends on whether the target NR cell on the carrier with CCA is known cell or unknown cell and on the frequency range (FR) of the target NR cell on the carrier with CCA. If the UE is not configured with intra-frequency NR carrier with CCA for RRC re-establishment then $T_{identify\_intra\_NR\_CCA}$=0; otherwise $T_{identify\_intra\_NR\_CCA}$ shall not exceed the values defined in Table 6.2.1A.2.1-1.

$T_{identify\_inter\_NR\_CCA,i}$: If the target inter-frequency carrier is the carrier without CCA, it is the time to identify the target inter-frequency NR cell which is defined in clause 6.2.1; otherwise it is the time to identify the target inter-frequency NR cell on inter-frequency carrier *i* with CCA configured for RRC re-establishment and it depends on whether the target NR cell on the inter-frequency carrier with CCA is known or unknown. $T_{identify\_inter\_NR\_CCA,i}$ shall not exceed the values defined in Table 6.2.1A.2.1-2.

T_{SMTC}: It is the periodicity of the SMTC occasion configured for the intra-frequency carrier. If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2*, T_{smtc} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.

$T_{SMTC,i}$: It is the periodicity of the SMTC occasion configured for the inter-frequency carrier *i*. If it is not configured, the UE may assume that the target SSB periodicity is not larger than 20 ms.

T_{SI-NR_CCA}: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for the target NR cell on the carrier with CCA.

Editor's note: The actual value for T_{SI-NR_CCA} is to be discussed in the performance part, considering LBT failures and receiver assumptions, etc.

T_{PRACH_CCA} is the delay uncertainty in acquiring the first available PRACH occasion in the target NR Cell on the carrier with CCA:

$T_{PRACH\_CCA} = (1+ K_3)*T_{SSB,RO} + 10$ ms, where:

- $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined inTable 8.1-1 of TS 38.213 [39].
- K_3 is the number of consecutive SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failure. $K_3 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [57].

N_{freq}: It is the total number of NR frequencies to be monitored for RRC re-establishment; $N_{freq} = 1$ if the target NR cell on the intra-frequency carrier with CCA is known, else $N_{freq} = 2$ and $T_{identify\_intra\_NR\_CCA} = 0$ if the target NR cell on the inter-frequency carrier with CCA is known.

There is no requirement if the target cell on the carrier with CCA does not contain the UE context.

In the requirement defined in the below tables, the target cell on the carrier with CCA is known if it has been meeting the relevant cell identification requirement during the last 8 seconds otherwise it is unknown.

Table 6.2.1A.2.1-1: Time to identify target NR cell for RRC connection re-establishment to NR intra-frequency cell with CCA

Serving cell SSB Ês/Iot (dB)	Frequency range (FR) of target NR cell	$T_{identify\_intra\_NR\_CCA}$ [ms]	
		Known NR cell	Unknown NR cell
⩾ -8	FR1	MAX (200 ms, (5+K_1) x T_{SMTC})	MAX (800 ms, (10+ K_1) x T_{SMTC})
< -8	FR1	N/A	(800+20 x K_1)[Note1]
Note 1: The UE is not required to successfully identify a cell on any NR frequency layer with CCA when T_{SMTC} > 20 ms and serving cell SSB Ês/Iot < -8 dB. Note 2: K_1 is the number of SMTC occasions not available at the UE due during RRC re-establishment period on the carrier with CCA.			

Table 6.2.1A.2.1-2: Time to identify target NR cell for RRC connection re-establishment to NR inter-frequency cell on the carrier with CCA

Serving cell SSB Ês/Iot (dB)	Frequency range (FR) of target NR cell	$T_{identify\_inter\_NR\_CCA, i}$ [ms]	
		Known NR cell	Unknown NR cell
⩾ -8	FR1	MAX (200 ms, ([6]+$K_{2,i}$) x $T_{SMTC, i}$)	MAX (800 ms, ([13]+$K_{2,i}$) x $T_{SMTC, i}$)
< -8	FR1	N/A	(800+20 x $K_{2,i}$) [Note1]
Note 1: The UE is not required to successfully identify a cell on any NR frequency layer with CCA when $T_{SMTC,i}$ > 20 ms and serving cell SSB Ês/Iot < -8 dB. Note 2: $K_{2,i}$ is the number of SMTC occasions not available at the UE during RRC re-establishment period on the "i" th carrier with CCA,			

6.2.2 Random access

6.2.2.1 Introduction

This clause contains requirements on the UE regarding random access procedure. The random access procedure is initiated to establish uplink time synchronization for a UE which either has not acquired or has lost its uplink synchronization, or to convey UE's request Other SI, or for beam failure recovery. The random access is specified in clause 8 of TS 38.213 [3] and the control of the RACH transmission is specified in clause 5.1 of TS 38.321 [7]. Two types of procedure are defined for the random access, the 4-step RA type, and the 2-step RA type [7]. The decision on which type of procedure to adopt is as described in clause 5.1.1 of TS 38.321 [7]. The requirements for the 4-step RA type procedure are described in clause 6.2.2.2, whereas the requirements for the 2-step RA type procedure are described in the clause 6.2.2.3 of this specification.

6.2.2.2 Requirements for 4-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in Table 6.3.4.2-1 of TS 38.101-1 [18] for FR1 and in Table 6.3.4.2-1 of TS 38.101-2 [19] for FR2. The relative power applied to additional preambles shall have an accuracy as specified in Table 6.3.4.3-1 of TS 38.101-1 [18] for FR1 and clause 6.3.4.3 of TS38.101-2 [19] for FR2.

The UE shall indicate a random access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4 in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode or any MR-DC operation mode.

6.2.2.2.1 Contention based random access

6.2.2.2.1.1 Correct behaviour when transmitting Random Access Preamble

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SSB is configured, as specified in clause 5.1.2 in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB*, UE shall have the capability to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

6.2.2.2.1.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2.2.2.1.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 in TS 38.321 [7].

6.2.2.2.1.4 Correct behaviour when receiving an UL grant for msg3 retransmission

The UE shall re-transmit the msg3 upon the reception of anUL grant for msg3 retransmission.

6.2.2.2.1.5 SA: Correct behaviour when receiving a message over Temporary C-RNTI

The UE shall send ACK if the Contention Resolution is successful.

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

6.2.2.2.1.6 Correct behaviour when contention Resolution timer expires

The UE shall re-select a preamble and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

6.2.2.2.2 Non-Contention based random access

6.2.2.2.2.1 Correct behaviour when transmitting Random Access Preamble

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs is configured, with the UE selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs, UE shall have the capability to select the Random Access Preamble corresponding to the selected CSI-RS, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

If the random access procedure is initialized for beam failure recovery and if the contention-free Random Access Resources and the contention-free PRACH occasions for beam failure recovery request associated with any of the SSBs and/or CSI-RSs is configured, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB with SS-RSRP above *rsrp-ThresholdSSB* amongst the associated SSBs or the selected CSI-RS with CSI-RSRP above *rsrp-ThresholdCSI-RS* amongst the associated CSI-RSs, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex* if configured, or from the PRACH occasions in *ra-OccasionList* corresponding to the selected CSI-RS, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB assocated PRACH occasions or the selected CSI-RS associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2 in TS 38.321 [7].

6.2.2.2.2.2 Correct behaviour when receiving Random Access Response

The UE may stop monitoring for Random Access Response(s), if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble, unless the random access procedure is initialized for Other SI request from UE.

The UE may stop monitoring for Random Access Response(s) and shall monitor the Other SI transmission if the Random Access Response only contains a Random Access Preamble identifier which is corresponding to the transmitted Random Access Preamble and the random access procedure is initialized for SI request from UE, as specified in clause 5.1.4 in TS 38.321 [7].

The UE may stop monitoring for Random Access Response(s), if the contention-free Random Access Preamble for beam failure recovery request was transmitted and if the PDCCH addressed to UE's C-RNTI is received, as specified in clause 5.1.4 in TS 38.321 [7].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2.2.2.2.3 Correct behaviour when not receiving Random Access Response

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2 in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated PRACH transmission power, if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon* or if no PDCCH addressed to UE's C-RNTI is received within the RA Response window configured in *BeamFailureRecoveryConfig*, as defined in clause 5.1.4 in TS 38.321 [7].

6.2.2.2.3 UE behaviour when configured with supplementary UL

In addition to the requirements defined in clause 6.2.2.2.1 and 6.2.2.2.2, a UE configured with supplementary UL carrier shall use RACH configuration for the supplementary UL carrier contained in RMSI and RRC dedicated signalling. If the cell for the random access procedure is configured with supplementary UL, the UE shall transmit or re-transmit PRACH preamble on the supplementary UL carrier if the SS-RSRP measured by the UE on the DL carrier is lower than the *rsrp-ThresholdSSB-SUL* as defined in TS 38.331 [2].

6.2.2.3 Requirements for 2-step RA type

The UE shall select the type of random access at initiation of the random access procedure based on network configuration, as specified in clause 5.1.1 in TS 38.321 [7].

The UE shall have capability to calculate MsgA PRACH transmission power according to the PRACH power formula defined in clause 7.4 of TS 38.213 [3] and the MsgA PUSCH power formula of clause 7.1.1 of TS 38.213 [3] and apply this power level at the first MsgA or additional MsgA repetitions. The absolute power applied to the first preamble shall have an accuracy as specified in Table 6.3.4.2-1 of TS 38.101-1 [18] for frequency range 1 and in Table 6.3.4.2-1 of TS 38.101-2 [19] for frequency range 2. The relative power applied to additional preambles shall have an accuracy as specified in Table 6.3.4.3-1 of TS 38.101-1 [18] for frequency range 1 and clause 6.3.4.3 of TS38.101-2 [19] for frequency range 2.

The UE shall switch to 4-step RA type procedure if the MsgA transmission counter has exceeded *msgA-TransMax*, if configured, as specified in clause 5.1.4a of TS 38.321 [7]. The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on PCell or PSCell as specified in clause 5.1.4a in TS 38.321 [7].

The requirements in this clause apply for UE in SA operation mode or any MR-DC operation mode.

6.2.2.3.1 Contention based random access

6.2.2.3.1.1 Correct behaviour when transmitting MsgA

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, the UE shall have the capability to select a Random Access Preamble randomly with equal probability from the Random Access Preambles associated with the selected SSB if the association between Random Access Preambles and SS blocks is configured, as specified in clause 5.1.2a in TS 38.321 [7].

With the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB*, UE shall have the capability to transmit MsgA PRACH on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, if the association between PRACH occasions and SSBs is configured.

The PRACH preamble and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE should have the capability to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH ocasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

6.2.2.3.1.2 Correct behaviour when receiving MsgB

The UE shall stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

The UE shall send ACK if Success RAR is received in MsgB and the Contention Resolution is successful, as defined in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH and monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

6.2.2.3.1.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires unless the Random Access Response reception is considered as successful, as defined in clause 5.1.4a in TS 38.321 [7].

6.2.2.3.2 Non-Contention based random access

6.2.2.3.2.1 Correct behaviour when transmitting MsgA

If the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs is configured, with the UE selected SSB with SS-RSRP above *msgA-RSRP-ThresholdSSB* amongst the associated SSBs, UE shall have the capability to select the Random Access Preamble corresponding to the selected SSB, and to transmit Random Access Preamble on the next available PRACH occasion from the PRACH occasions corresponding to the selected SSB permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured, and PRACH occasion shall be randomly selected with equal probability amongst the selected SSB associated PRACH occasions occurring simultaneously but on different subcarriers, as specified in clause 5.1.2a in TS 38.321 [7].

In association with the MsgA PRACH, the UE should have the capability to transmit MsgA PUSCH on the corresponding PUSCH occasion associated with a DMRS resource, which is mapped from the MsgA PRACH ocasion, and preamble index as defined in clause 8.1A in TS 38.213 [3].

6.2.2.3.2.2 Correct behaviour when receiving MsgB

The UE may stop monitoring for MsgB, when the UE has successfully received the PDCCH addressed to UE as specified in clause 8.2A in TS 38.213 [3] containing a successRAR MAC subPDU or a fallbackRAR MAC subPDU as described in clause 5.1.4a in TS 38.321 [7].

If MsgB contains a fallbackRAR MAC subPDU the UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit the preamble with the calculated MsgA PRACH and MsgA PUSCH transmission power if all received MsgBs contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.2.2.3.2.3 Correct behaviour when not receiving MsgB

The UE shall again perform the Random Access Resource selection procedure defined in clause 5.1.2a in TS 38.321 [7] for the next available PRACH occasion, and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power, if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA* and the Random Access Response Reception has not been considered as successful as defined in clause 5.1.4a in TS 38.321 [7].

6.2.2.3.3 UE behaviour when configured with supplementary UL

In addition to the requirements defined in clause 6.2.2.3.1 and 6.2.2.3.2, a UE configured with supplementary UL carrier shall use RACH configuration for the supplementary UL carrier contained in RMSI and RRC dedicated signalling. If the cell for the random access procedure is configured with supplementary UL, the UE shall transmit or re-transmit PRACH preamble on the supplementary UL carrier if the SS-RSRP measured by the UE on the DL carrier is lower than the *rsrp-ThresholdSSB-SUL* as defined in TS 38.321 [7].

6.2.3 SA: RRC Connection Release with Redirection

6.2.3.1 Introduction

This clause contains requirements on the UE regarding RRC connection release with redirection procedure. RRC connection release with redirection is initiated by the *RRCRelease* message with redirection to E-UTRAN or NR from NR specified in TS 38.331 [2]. The RRC connection release with redirection procedure is specified in clause 5.3.8 of TS 38.331 [2].

In the requirements of clause 6.2.3.2, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding identification period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 6.2.3.2, the term PRACH occasion unavailable for transmission refers to when the PRACH occasion is configured by gNB but not transmitted by the UE during the corresponding period due to UL CCA failure at the UE.

6.2.3.2 Requirements

6.2.3.2.1 RRC connection release with redirection to NR

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell within $T_{connection\_release\_redirect\_NR}$.

The time delay ($T_{connection\_release\_redirect\_NR}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay ($T_{connection\_release\_redirect\_NR}$) shall be less than:

$$T_{connection\_release\_redirect\_NR} = T_{RRC\_procedure\_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH}$$

The target NR cell shall be considered detetable when for each relevant SSB, the side conditions should be met that,

- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.5 for a corresponding NR Band are fulfilled.

$T_{RRC\_procedure\_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

$T_{identify\text{-}NR}$: It is the time to identify the target NR cell and depends on the FR of the target NR cell. It is defined in Table 6.2.3.2.1-1. Note that $T_{identify\text{-}NR} = T_{PSS/SSS\text{-}sync} + T_{meas}$, in which $T_{PSS/SSS\text{-}sync}$ is the cell search time and T_{meas} is the measurement time due to cell selection criteria evaluation.

$T_{SI\text{-}NR}$: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released. T_{RACH}: It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell. T_{RACH} can be up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in the table 8.1-1 of TS 38.213 [3].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise T_{rs} is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with T_{rs} = 20 ms if the SSB transmission periodicity is not larger than 20 ms; otherwise,
- there is no requirement if the SSB transmission periodicity is larger than 20ms.

Table 6.2.3.2.1-1: Time to identify target NR cell for RRC connection release with redirection to NR

FR of target NR cell	$T_{identify\text{-}NR}$
FR1	MAX (680 ms, 11 x T_{rs})
FR2	MAX (880 ms, 8x11 x T_{rs})
Note: If the UE has been provided with higher layer signaling of *smtc2* specified in TS 38.331 [2] prior to the redirection command, T_{rs} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell.	

6.2.3.2.2 RRC connection release with redirection to E-UTRAN

The UE shall be capable of performing the RRC connection release with redirection to the target E-UTRAN cell within $T_{connection\_release\_redirect\_E\text{-}UTRA}$.

The time delay ($T_{connection\_release\_redirect\_E\text{-}UTRA}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the PDSCH and the time the UE starts to send random access to the target E-UTRA cell. The time delay ($T_{connection\_release\_redirect\_E\text{-}UTRA}$) shall be less than:

$$T_{connection\_release\_redirect\_E\text{-}UTRA} = T_{RRC\_procedure\_delay} + T_{identify\text{-}E\text{-}UTRA} + T_{SI\text{-}E\text{-}UTRA} + T_{RACH}$$

The target E-UTRA FDD or TDD cell shall be considered detectable provided the following conditions are fulfilled:

- the same conditions as for inter-frequency RSRP measurements specified in annex B.1.2 of TS 36.133 [15] are fulfilled for a corresponding Band, and
- the same conditions as for inter-frequency RSRQ measurements specified in annex B.1.2 of TS 36.133 [15] are fulfilled for a corresponding Band, and
- SCH conditions specified in annex B.1.2 of TS 36.133 [15] are fulfilled for a corresponding Band.

$T_{RRC\_procedure\_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

$T_{identify\text{-}E\text{-}UTRA}$: It is the time to identify the target E-UTRA cell. It shall be less than 320 ms.

$T_{SI\text{-}E\text{-}UTRA}$: It is the time required for acquiring all the relevant system information of the target E-UTRA cell. This time depends upon whether the UE is provided with the relevant system information (SI) of the target E-UTRA cell or not by the old NR cell before the RRC connection is released.

T_{RACH}: It is the delay caused due to the random access procedure when sending random access to the target E-UTRA cell.

6.2.3.2.3 RRC connection release with redirection to NR carrier subject to CCA

The UE shall be capable of performing the RRC connection release with redirection to the target NR cell subject to CCA within $T_{connection\_release\_redirect\_NR\_CCA}$.

The time delay ($T_{connection\_release\_redirect\_NR\_CCA}$) is the time between the end of the last slot containing the RRC command, "*RRCRelease*" (TS 38.331 [2]) on the NR PDSCH and the time the UE starts to send random access to the target NR cell. The time delay ($T_{connection\_release\_redirect\_NR\_CCA}$) shall be less than:

$$T_{connection\_release\_redirect\_NR\_CCA} = T_{RRC\_procedure\_delay} + T_{identify\text{-}NR\_CCA} + T_{SI\text{-}NR\_CCA} + T_{RACH\_CCA}$$

The target NR cell shall be considered detetable when for each relevant SSB, the side conditions should be met that,

- the conditions of SSB_RP and SSB Ês/Iot according to Annex B.2.5 for a corresponding NR Band are fulfilled.

$T_{RRC\_procedure\_delay}$: It is the RRC procedure delay for processing the received message "*RRCRelease*" as defined in clause 6.2.2 of TS 38.331 [2].

$T_{identify\text{-}NR\_CCA}$: It is the time to identify the target NR cell and is defined as:

- $T_{identify\text{-}NR\_CCA} = T_{PSS/SSS\text{-}sync} + T_{meas}$; $T_{PSS/SSS\text{-}sync}$ is the cell search time and T_{meas} is the measurement time due to cell selection criteria evaluation.
- $T_{identify\text{-}NR\_CCA}$ = MAX (680 ms, $(L_1+11) \times T_{rs}$); where L_1 is the number of SMTC occasions not available at the UE due to DL CCA failures. If $L_1 > L_{1,max}$ then the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1]; where $L_{1,max}$ is defined in Table 6.2.3.2.3-1.

$T_{SI\text{-}NR\_CCA}$: It is the time required for acquiring all the relevant system information of the target NR cell. This time depends upon whether the UE is provided with the relevant system information of the target NR cell or not by the old NR cell before the RRC connection is released.

$T_{RACH\_CCA:}$ It is the delay uncertainty in acquiring the first available PRACH occasion in the target NR cell:

- $T_{RACH\_CCA} = (1+L_2)\times T_{SSB,RO}$ + 10 ms T_{PRACH}; where:
  - L_2 is the consecutive number of SSB to PRACH occasion association periods during which no PRACH occasion is available for PRACH transmission due to UL CCA failures. $L_2 = 0$ for Type 2C UL channel access procedure as defined in TS 37.213 [33].
  - $T_{SSB,RO}$ is the SSB to PRACH occasion association period as defined in the table 8.1-1 of TS 38.213 [3].
  - The value of L2 is limited by *PREAMBLE_TRANSMISSION_COUNTER*, which is increased when PRACH occasion is unavailable for PRACH transmission due to UL CCA failure as specified in TS 38.321 [7]. The UE behaviour when *PREAMBLE_TRANSMISSION_COUNTER* reaches the *preambleTransMax* is specified in TS 38.321 [7].

T_{rs} is the SMTC periodicity of the target NR cell if the UE has been provided with an SMTC configuration for the target cell in the redirection command, otherwise T_{rs} is the SMTC periodicity configured in the *measObjectNR* having the same SSB frequency and subcarrier spacing configured for the RRC connection release with redirection. If the UE is not provided with SMTC configuration or measurement object for the frequency which is also configured for the RRC connection release with redirection then:

- the requirement in this clause is applied with T_{rs} = 20 ms if the SSB transmission periodicity is not larger than 20 ms;
- otherwise, there is no requirement if the SSB transmission periodicity is larger than 20ms.

Table 6.2.3.2.3-1: Maximum allowed number of missed SMTC occasions during cell identification

SMTC periodicity (T_{rs}) [ms]	Maximum allowed number of missed SMTC occasions ($L_{1,max}$)
$T_{rs} \le 40$	8
$T_{rs} > 40$	4

7 Timing

7.1 UE transmit timing

7.1.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in connected state. The uplink frame transmission takes place $(N_{TA} + N_{TA\ offset}) \times T_c$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. For serving cell(s) in pTAG, UE shall use the SpCell as the reference cell for deriving the UE transmit timing for cells in the pTAG. For serving cell(s) in sTAG, UE shall use any of the activated SCells as the reference cell for deriving the UE transmit timing for the cells in the sTAG. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

In the requirements of clause 7.1.2, the term reference cell on a carrier frequency subject to CCA is not available at the UE refers to when at least one SSB is configured by gNB, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the last 160 ms; otherwise the reference cell on the carrier frequency subject to CCA is considered as available at the UE.

7.1.2 Requirements

The UE initial transmission timing error shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is specified in Table 7.1.2-1. This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission..

The UE shall meet the Te requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus $(N_{TA} + N_{TA\ offset}) \times T_c$. The downlink timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the reference cell. N_{TA} for PRACH is defined as 0.

$(N_{TA} + N_{TA\ offset}) \times T_c$ (in T_c units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3 was applied. N_{TA} for other channels is not changed until next timing advance is received. The value of $N_{TA\ offset}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N_{TA\ offset}$ is defined in Table 7.1.2-2.

Table 7.1.2-1: T_e Timing Error Limit

Frequency Range	SCS of SSB signals (kHz)	SCS of uplink signals (kHz)	T_e
1	15	15	$12*64*T_c$
		30	$10*64*T_c$
		60	$10*64*T_c$
	30	15	$8*64*T_c$
		30	$8*64*T_c$
		60	$7*64*T_c$
2	120	60	$3.5*64*T_c$
		120	$3.5*64*T_c$
	240	60	$3*64*T_c$
		120	$3*64*T_c$
Note 1: T_c is the basic timing unit defined in TS 38.211 [6]			

Table 7.1.2-2: The Value of $N_{\text{TA offset}}$

Frequency range and band of cell used for uplink transmission	$N_{\text{TA offset}}$ (Unit: T_C)
FR1 FDD or TDD band with neither E-UTRA–NR nor NB-IoT–NR coexistence case	25600 (Note 1)
FR1 FDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case	0 (Note 1)
FR1 TDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case	39936 (Note 1)
FR2	13792
Note 1: The UE identifies $N_{\text{TA offset}}$ based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of $N_{\text{TA offset}}$ is set as 25600 for FR1 band. In case of multiple UL carriers in the same TAG, UE expects that the same value of n-TimingAdvanceOffset is provided for all the UL carriers according to clause 4.2 in TS 38.213 [3] and the value 39936 of $N_{\text{TA offset}}$ can also be provided for a FDD serving cell. Note 2: Void	

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell except when the timing advance in clause 7.3 is applied.

Table 7.1.2-3: void

If the UE uses a reference cell on a carrier frequency subject to CCA for deriving the UE transmit timing, then the UE shall meet all the transmit timing requirements defined in clause 7.1.2 provided that the reference cell is available at the UE during the last 160 ms. If the reference cell is not available at the UE during the last 160 ms on a carrier frequency subject to CCA, then the UE is allowed to transmit in the uplink provided that the UE meets all the transmit timing requirements defined in clause 7.1.2; otherwise the UE shall not transmit any uplink signal.

If a reference cell on a carrier frequency belonging to the PTAG, which is subject to CCA, is not available at the UE for more than 160 ms then the UE is allowed to use any of available activated SCell(s) at the UE in PTAG as a new reference cell. If the SCell used as reference cell is deactivated, or becomes not available for more than 160 ms, the UE is allowed to use another active serving cell in PTAG as new reference cell.

If a reference cell on a carrier frequency belonging to the STAG, which is subject to CCA is not available at the UE for more than 160 ms then the UE is allowed to use any of available activated SCell(s) at the UE in STAG as a new reference cell.

7.1.2.1 Gradual timing adjustment

Requirements in this section shall apply regardless of whether the reference cell is on a carrier frequency subject to CCA or not.

When the transmission timing error between the UE and the reference timing exceeds $\pm T_e$ then the UE is required to adjust its timing to within $\pm T_e$. The reference timing shall be $(N_{\mathrm{TA}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ before the downlink timing of the reference cell. All adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change in one adjustment shall be T_q.

2) The minimum aggregate adjustment rate shall be T_p per second.

3) The maximum aggregate adjustment rate shall be T_q per 200 ms.

   where the maximum autonomous time adjustment step T_q and the aggregate adjustment rate T_p are specified in Table 7.1.2.1-1.

Table 7.1.2.1-1: T_q Maximum Autonomous Time Adjustment Step and T_p Minimum Aggregate Adjustment rate

Frequency Range	SCS of uplink signals (kHz)	T_q	T_p
1	15	5.5*64*T_c	5.5*64*T_c
	30	5.5*64*T_c	5.5*64*T_c
	60	5.5*64*T_c	5.5*64*T_c
2	60	2.5*64*T_c	2.5*64*T_c
	120	2.5*64*T_c	2.5*64*T_c
NOTE: T_c is the basic timing unit defined in TS 38.211 [6]			

7.1.2.2 Void

Table 7.1.2.2-1: Void

7.2 UE timer accuracy

7.2.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

7.2.2 Requirements

For UE timers specified in TS 38.331 [2], the UE shall comply with the timer accuracies according to Table 7.2.2-1.

The requirements are only related to the actual timing measurements internally in the UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. UE reaction time to detect that start and stop conditions of a timer is fulfilled), or

- Inaccuracies due to restrictions in observability of start and stop conditions of a UE timer (e.g. slot alignment when UE sends messages at timer expiry).

Table 7.2.2-1

Timer value [s]	Accuracy
timer value < 4	± 0.1s
timer value ≥ 4	± 2.5%

7.3 Timing advance

7.3.1 Introduction

The timing advance is initiated from gNB to UE in EN-DC, NR-DC, NE-DC and NR SA operation modes, with MAC message that implies the adjustment of the timing advance, as defined in clause 5.2 of TS 38.321 [7].

7.3.2 Requirements

7.3.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission timing at time slot $n+ k+1$ for a timing advance command received in time slot n, and the value of k is defined in clause 4.2 in TS 38.213 [3]. The same requirement applies also when the UE is not able to transmit a configured uplink transmission due to the channel assessment procedure.

7.3.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to the UE Timing Advance adjustment accuracy requirement in Table 7.3.2.2-1, to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command step is defined in TS 38.213 [3].

Table 7.3.2.2-1: UE Timing Advance adjustment accuracy

UL Sub Carrier Spacing(kHz)	15	30	60	120
UE Timing Advance adjustment accuracy	$\pm 256\ T_c$	$\pm 256\ T_c$	$\pm 128\ T_c$	$\pm 32\ T_c$

7.4 Cell phase synchronization accuracy

7.4.1 Definition

Cell phase synchronization accuracy for TDD is defined as the maximum absolute deviation in frame start timing between any pair of cells on the same frequency that have overlapping coverage areas.

7.4.2 Minimum requirements

The cell phase synchronization accuracy measured at BS antenna connectors shall be better than 3 µs.

7.5 Maximum Transmission Timing Difference

7.5.1 Introduction

A UE shall be capable of handling a relative transmission timing difference between subframe timing boundary of E-UTRA PCell and the closest slot timing boundary of PSCell to be aggregated for EN-DC operation.

A UE shall be capable of handling a relative transmission timing difference among the closest slot timing boundaries of different carriers to be aggregated in NR carrier aggregation.

A UE shall be capable of handling a relative transmission timing difference between slot timing boundary of PCell and subframe timing boundary of E-UTRA PSCell to be aggregated for NE-DC operation.

A UE shall be capable of handling a relative transmission timing difference between slot timing boundaries of PCell and the closest slot timing boundary of PSCell to be aggregated in NR DC operation.

7.5.2 Minimum Requirements for inter-band EN-DC

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.2-1.

Table 7.5.2-1 Maximum uplink transmission timing difference requirement for asynchronous EN-DC

Sub-carrier spacing in E-UTRA PCell (kHz)	UL Sub-carrier spacing for data in PSCell (kHz)	Maximum uplink transmission timing difference (μs)
15	15	500
15	30	250
15	60	125
15	120[Note1]	62.5
NOTE 1: For E-UTRA FDD-NR FDD intra-band EN-DC, for which the requirement is defined in clause 7.5.3 and this Table 7.5.2-1 is also applicable, the scenario with 120kHz PSCell does not exist.		

Table 7.5.2-2 Void

7.5.2.1 Minimum Requirements for inter-band synchronous EN-DC

The requirements in this clause apply as a reference for inter-band synchronous EN-DC.

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell for inter-band synchronous EN-DC as shown in Table 7.5.2.1-1 1. The requirements for synchronous EN-DC are applicable for E-UTRA TDD-NR TDD, E-UTRA FDD-NR FDD, E-UTRA TDD-NR FDD and E-UTRA FDD-NR TDD inter-band EN-DC.

Table 7.5.2.1-1 Maximum uplink transmission timing difference requirement for inter-band synchronous EN-DC

Sub-carrier spacing in E-UTRA PCell (kHz)	UL Sub-carrier spacing for data in PSCell (kHz)	Maximum uplink transmission timing difference (μs)
15	15	35.21
15	30	35.21
15	60	35.21
15	120	35.21

7.5.3 Minimum Requirements for intra-band EN-DC

For intra-band EN-DC, only co-located deployment is applied.

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.2-1 for E-UTRA FDD-NR FDD intra-band EN-DC provided the UE indicates that it is capable of asynchronous EN-DC operation [2].

The UE shall be capable of handling a maximum uplink transmission timing difference between E-UTRA PCell and PSCell as shown in Table 7.5.3-1 for E-UTRA TDD-NR TDD and E-UTRA FDD-NR FDD intra-band EN-DC provided the UE does not indicate that it is capable of asynchronous FDD-FDD EN-DC operation [16].

Table 7.5.3-1: Maximum uplink transmission timing difference requirement for intra-band synchronous EN-DC

Sub-carrier spacing in E-UTRA PCell (kHz)	UL Sub-carrier spacing for data in PSCell (kHz)	Maximum uplink transmission timing difference (µs)
15	15	5.21 Note1,Note 2
15	30	5.21 Note 2
15	60	5.21 Note 2
NOTE 1: This is not applicable for a UE which indicates the capability of only supporting single UL timing (*ul-TimingAlignmentEUTRA-NR* is signalled). Single UL timing for E-UTRA and NR cell is assumed for this UE. NOTE 2: If the transmission timing difference exceeds the cyclic prefix length of the UL Sub-carrier spacing for data in PSCell, NR UE Tx EVM degradation is expected for the symbol that is overlapping the LTE subframe boundary		

7.5.4 Minimum Requirements for NR Carrier Aggregation

The UE shall be capable of handling at least a relative transmission timing difference between slot timing of all pairs of TAGs as shown in Table 7.5.4-1, provided that the UE is:

- configured with the pTAG and the sTAG for inter-band NR carrier aggregation in SA or NR-DC mode, or
- configured with more than one sTAG for inter-band NR carrier aggregation in EN-DC or NE-DC mode.

Table 7.5.4-1: Maximum uplink transmission timing difference requirement for inter-band NR carrier aggregation

Frequency Range of the pair of TAGs	Maximum uplink transmission timing difference (µs)
FR1	34.6
FR2	8.5 Note1
Between FR1 and FR2	26.1
Note1: This requirement applies to the UE capable of independent beam management for FR2 inter-band CA.	

7.5.5 Minimum Requirements for inter-band NE-DC

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and E-UTRA PSCell as shown in Table 7.5.5-1 for inter-band asynchronous NE-DC.

Table 7.5.5-1: Maximum uplink transmission timing difference requirement for inter-band asynchronous NE-DC

Sub-carrier spacing in PCell (kHz)	UL Sub-carrier spacing for data in E-UTRA PSCell (kHz)	Maximum uplink transmission timing difference (µs)
15	15	500
30	15	250
60	15	125
120	15	62.5
NOTE 1: Void		

Table 7.5.5-2 Void

7.5.5.1 Minimum Requirements for inter-band synchronous NE-DC

The requirements in this clause apply as a reference for inter-band synchronous NE-DC.

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and E-UTRA PSCell for inter-band synchronous NE-DC as shown in Table 7.5.5.1-1. The requirements for synchronous NE-DC are applicable for NR TDD- E-UTRA TDD, NR FDD- E-UTRA FDD, NR TDD- E-UTRA FDD and NR FDD- E-UTRA TDD inter-band NE-DC.

Table 7.5.5.1-1: Maximum uplink transmission timing difference requirement for inter-band synchronous NE-DC

Sub-carrier spacing in PCell (kHz)	UL Sub-carrier spacing for data in E-UTRA PSCell (kHz)	Maximum uplink transmission timing difference (µs)
15	15	35.21
30	15	35.21
60	15	35.21
120	15	35.21

7.5.6 Minimum Requirements for inter-band NR DC

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell as shown in Table 7.5.6-1 provided that the UE indicates that it is capable of synchronous NR DC only [16].

Table 7.5.6-1: Maximum uplink transmission timing difference requirement for inter-band synchronous NR DC

Frequency Range		Maximum uplink transmission timing difference (µs)
Cell in MCG	Cell in SCG	
FR1	FR1	34.6
FR2	FR2	8.5
FR1	FR2	34.1

The UE shall be capable of handling a maximum uplink transmission timing difference between PCell and PSCell as shown in Table 7.5.6-2 provided that the UE indicates that it is capable of asynchronous NR DC [16].

Table 7.5.6-2 Maximum uplink transmission timing difference requirement for inter-band asynchronous NR DC

Max {Sub-carrier spacing in PCell (kHz), Sub-carrier spacing in PSCell (kHz)}	Maximum uplink transmission timing difference (µs)
15	500
30	250
60	125

7.6 Maximum Receive Timing Difference

7.6.1 Introduction

A UE shall be capable of handling a relative receive timing difference between subframe timing boundary of an E-UTRA cell belonging to the MCG and the closest slot timing boundary of a cell belonging to SCG to be aggregated for EN-DC operation.

A UE shall be capable of handling a relative receive timing difference between subframe timing boundary of an E-UTRA cell belonging to the SCG to be aggregated for NE-DC operation and the closest slot timing boundary of a cell belonging to MCG.

A UE shall be capable of handling a relative receive timing difference between slot timing boundary of a cell belonging to MCG and the closest slot timing boundary of a cell belonging to the SCG to be aggregated for NR DC operation. A UE shall be capable of handling a relative receive timing difference among the closest slot timing boundaries of different carriers to be aggregated in NR carrier aggregation.

7.6.2 Minimum Requirements for inter-band EN-DC

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to SCG at the UE receiver as shown in Table 7.6.2-1.

Table 7.6.2-1: Maximum receive timing difference requirement for asynchronous EN-DC

Sub-carrier spacing of E-UTRA cell in MCG (kHz)	DL Sub-carrier spacing of cell in SCG (kHz) (Note 1)	Maximum receive timing difference (μs)
15	15	500
15	30	250
15	60	125
15	120 Note2	62.5
NOTE 1: DL Sub-carrier spacing is min{SCS_{SS}, SCS_{DATA}}. NOTE 2: For E-UTRA FDD-NR FDD intra-band EN-DC, for which the requirement is defined in clause 7.6.3 and this Table 7.6.2-1 is also applicable, the scenario with 120 kHz does not exit.		

Table 7.6.2-2 Void

Table 7.6.2-3 Void

7.6.2.1 Minimum Requirements for inter-band synchronous EN-DC

The requirements in this clause apply as a reference for inter-band synchronous EN-DC.

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from an E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to SCG at the UE receiver for inter-band synchronous EN-DC as shown in Table 7.6.2.1-1. The requirements for synchronous EN-DC are applicable for E-UTRA TDD-NR TDD, E-UTRA FDD-NR FDD, E-UTRA TDD-NR FDD and E-UTRA FDD-NR TDD inter-band EN-DC.

Table 7.6.2.1-1: Maximum receive timing difference requirement for inter-band synchronous EN-DC

Sub-carrier spacing of E-UTRA cell in MCG (kHz)	DL Sub-carrier spacing of cell in SCG (kHz) (Note1)	Maximum receive timing difference (μs)
15	15	33
15	30	
15	60	
15	120	
Note 1: DL Sub-carrier spacing is min{SCS_{SS}, SCS_{DATA}}.		

7.6.3 Minimum Requirements for intra-band EN-DC

For intra-band EN-DC, only co-located deployment is applied.

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG as shown in Table 7.6.2-1 for E-UTRA FDD-NR FDD intra-band EN-DC provided the UE indicates that it is capable of asynchronous EN-DC operation [2].

The UE shall be capable of handling at least a relative receive timing difference between subframe timing of signal from a E-UTRA cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG as shown in

Table 7.6.3-1 for E-UTRA FDD-NR FDD and E-UTRA TDD-NR TDD intra-band EN-DC provided the UE does not indicate that it is capable of asynchronous FDD-FDD EN-DC operation [16].

Table 7.6.3-1 Maximum receive timing difference requirement for intra-band synchronous EN-DC

Sub-carrier spacing of E-UTRA cell in MCG (kHz)	DL Sub-carrier spacing of cell in SCG (kHz) Note1	Maximum receive timing difference (μs)
15	15	3
15	30	3
15	60	3
NOTE 1: DL Sub-carrier spacing is min{SCS_{SS}, SCS_{DATA}}.		

Table 7.6.3-2 Void

7.6.4 Minimum Requirements for NR Carrier Aggregation

For intra-band CA, only co-located deployment is applied. For intra-band non-contiguous NR carrier aggregation, the UE shall be capable of handling at least a relative receive timing difference between slot timing of different carriers to be aggregated at the UE receiver as shown in Table 7.6.4-1 below.

Table 7.6.4-1: Maximum receive timing difference requirement for intra-band non-contiguous NR carrier aggregation

Frequency Range	Maximum receive timing difference (μs)
FR1	3[1]
FR2	0.26
Note 1: In the case of different SCS on different CCs, if the receive time difference exceeds the cyclic prefix length of that SCS, demodulation performance degradation is expected for the first symbol of the slot.	

For inter-band NR carrier aggregation, the UE shall be capable of handling at least a relative receive timing difference between slot timing of all pairs of carriers to be aggregated at the UE receiver as shown in Table 7.6.4-2 below.

Table 7.6.4-2: Maximum receive timing difference requirement for inter-band NR carrier aggregation

Frequency Range of the pair of carriers	Maximum receive timing difference (μs)
FR1	33
FR2	8 note1
Between FR1 and FR2	25
Note1: This requirement applies to the UE capable of independent beam management for FR2 inter-band CA.	

7.6.5 Minimum Requirements for inter-band NE-DC

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and subframe timing of signal from an E-UTRA cell belonging to the SCG at the UE receiver for asynchronous NE-DC as shown in Table 7.6.5-1.

Table 7.6.5-1: Maximum receive timing difference requirement for asynchronous NE-DC

Sub-carrier spacing of cell in MCG (kHz)	DL Sub-carrier spacing of EUTRA cell in SCG (kHz) (Note 1)	Maximum receive timing difference (μs)
15	15	500
30	15	250
60	15	125
120	15	62.5
NOTE 1: DL Sub-carrier spacing is min{SCS_{SS}, SCS_{DATA}}. NOTE 2: Void		

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and subframe timing of signal from a E-UTRA cell belonging to the SCG at the UE receiver for inter-band synchronous NE-DC as shown in Table 7.6.5-2. The requirements for synchronous NE-DC are applicable for NR TDD- E-UTRA TDD, NR FDD- E-UTRA FDD, NR TDD- E-UTRA FDD and NR FDD- E-UTRA TDD inter-band NE-DC.

Table 7.6.5-2: Void

7.6.5.1 Minimum Requirements for inter-band synchronous NE-DC

The requirements in this clause apply as a reference for inter-band synchronous NE-DC.

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and subframe timing of signal from a E-UTRA cell belonging to the SCG at the UE receiver for inter-band synchronous NE-DC as shown in Table 7.6.5.1-1. The requirements for synchronous NE-DC are applicable for NR TDD- E-UTRA TDD, NR FDD- E-UTRA FDD, NR TDD- E-UTRA FDD and NR FDD- E-UTRA TDD inter-band NE-DC.

Table 7.6.5.1-1: Maximum receive timing difference requirement for inter-band synchronous NE-DC

Sub-carrier spacing of cell in MCG (kHz)	DL Sub-carrier spacing of EUTRA cell in SCG (kHz) (Note1)	Maximum receive timing difference (μs)
15	15	33
30	15	
60	15	
120	15	

7.6.6 Minimum Requirements for inter-band NR DC

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in Table 7.6.6-1 provided that the UE indicates that it is capable of synchronous NR DC only [16].

Table 7.6.6-1: Maximum receive timing difference requirement for inter-band synchronous NR DC

Frequency Range		Maximum receive timing difference (μs)
Cell in MCG	Cell in SCG	
FR1	FR1	33
FR2	FR2	8
FR1	FR2	33

The UE shall be capable of handling at least a relative receive timing difference between slot timing of signal from a cell belonging to the MCG and slot timing of signal from a cell belonging to the SCG at the UE receiver as shown in Table 7.6.6-2 provided that the UE indicates that it is capable of asynchronous NR DC [16].

Table 7.6.6-2 Maximum receive timing difference requirement for inter-band asynchronous NR DC

Max {Sub-carrier spacing in PCell (kHz), Sub-carrier spacing in PSCell (kHz)}	Maximum receive timing difference (μs)
15	500
30	250
60	125
120	62.5

7.7 *deriveSSB-IndexFromCell* tolerance

7.7.1 Minimum requirements

When *deriveSSB-IndexFromCell* is enabled, the UE assumes frame boundary alignment (including half frame, subframe and slot boundary alignment) across cells on the same frequency carrier is within a tolerance not worse than min(2 SSB symbols, 1 PDSCH symbol) and the SFNs of all cells on the same frequency carrier are the same.

7.8 Void

8 Signalling characteristics

8.1 Radio Link Monitoring

8.1.1 Introduction

The requirements in clause 8.1 apply for radio link monitoring on:

- PCell in SA NR, NR-DC and NE-DC operation mode,
- PSCell in NR-DC and EN-DC operation mode.

The UE shall monitor the downlink radio link quality based on the reference signal configured as RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell and PSCell as specified in TS 38.213 [3]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. UE is not required to perform RLM outside the active DL BWP.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds Q_{out} and Q_{in} for the purpose of monitoring downlink radio link quality of the cell.

The threshold Q_{out} is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate ($BLER_{out}$) as defined in Table 8.1.1-1. For SSB based radio link monitoring, Q_{out_SSB} is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1.2.1-1. For CSI-RS based radio link monitoring, Q_{out_CSI-RS} is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1.3.1-1.

The threshold Q_{in} is defined as the level at which the downlink radio link quality can be received with significantly higher reliability than at Q_{out} and shall correspond to the in-sync block error rate ($BLER_{in}$) as defined in Table 8.1.1-1. For SSB based radio link monitoring, Q_{in_SSB} is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1.2.1-2. For CSI-RS based radio link monitoring, Q_{in_CSI-RS} is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1.3.1-2.

The out-of-sync block error rate ($BLER_{out}$) and in-sync block error rate ($BLER_{in}$) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *rlmInSyncOutOfSyncThreshold* from the network, UE determines out-of-sync and in-sync block error rates from

Configuration #0 in Table 8.1.1-1 by default. All requirements in clause 8.1 are applicable for BLER Configuration #0 in Table 8.1.1-1.

Table 8.1.1-1: Out-of-sync and in-sync block error rates

Configuration	$BLER_{out}$	$BLER_{in}$
0	10%	2%

UE shall be able to monitor up to N_{RLM} RLM-RS resources of the same or different types in each corresponding carrier frequency range, depending on a maximum number L_{max} of SSBs per half frame according to TS 38.213 [3], where N_{RLM} is specified in Table 8.1.1-2 according TS 38.213 [3], and meet the requirements as specified in clause 8.1. UE is not required to meet the requirements in clause 8.1 if RLM-RS is not configured and no TCI state for PDCCH is activated.

Table 8.1.1-2: Maximum number of RLM-RS resources N_{RLM}

Carrier frequency range of PCell/PSCell	L_{max}	Maximum number of RLM-RS resources, N_{RLM}
FR1, ≤ 3 GHz[Note]	4	2
FR1, > 3 GHz[Note]	8	4
FR2	64	8
NOTE: For unpaired spectrum operation with Case C - 30 kHz SCS, 3GHz is replaced by 1.88GHz, as specified in clause 4.1 in TS 38.213 [3].		

8.1.2 Requirements for SSB based radio link monitoring

8.1.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell or PSCell, provided that the SSB configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1.2.2.

Table 8.1.2.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1.2.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.1.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_out\_SSB}$ [ms] period becomes worse than the threshold Q_{out_SSB} within $T_{Evaluate\_out\_SSB}$ [ms] evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_in\_SSB}$ [ms] period becomes better than the threshold Q_{in_SSB} within $T_{Evaluate\_in\_SSB}$ [ms] evaluation period.

$T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ are defined in Table 8.1.2.2-1 for FR1.

$T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ are defined in Table 8.1.2.2-2 for FR2 with scaling factor N=8.

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, and these measurement gaps are overlapping with some but not all occasions of the SSB; and
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when RLM-RS resource is not overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when the RLM-RS resource is not overlapped with measurement gap and RLM-RS resource is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the RLM-RS is partially overlapped with measurement gap and the RLM-RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MRGP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor} = 1$, if the RLM-RS resource outside measurement gap is
    - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and,
    - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.
- $P_{sharing\ factor} = 3$, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 8.1.2.2-1: Evaluation period $T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ for FR1

Configuration	$T_{Evaluate\_out\_SSB}$ (ms)	$T_{Evaluate\_in\_SSB}$ (ms)
no DRX	Max(200, Ceil(10 × P) × T_{SSB})	Max(100, Ceil(5 × P) × T_{SSB})
DRX cycle≤320ms	Max(200, Ceil(15 × P) × Max(T_{DRX},T_{SSB}))	Max(100, Ceil(7.5 × P) × Max(T_{DRX},T_{SSB}))
DRX cycle>320ms	Ceil(10 × P) × T_{DRX}	Ceil(5 × P) × T_{DRX}
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

Table 8.1.2.2-2: Evaluation period $T_{Evaluate\_out\_SSB}$ and $T_{Evaluate\_in\_SSB}$ for FR2

Configuration	$T_{Evaluate\_out\_SSB}$ (ms)	$T_{Evaluate\_in\_SSB}$ (ms)
no DRX	Max(200, Ceil(10 × P × N) × T_{SSB})	Max(100, Ceil(5 × P × N) × T_{SSB})
DRX cycle≤320ms	Max(200, Ceil(15 × P × N) × Max(T_{DRX},T_{SSB}))	Max(100, Ceil(7.5 × P × N) × Max(T_{DRX},T_{SSB}))
DRX cycle>320ms	Ceil(10 × P × N) × T_{DRX}	Ceil(5 × P × N) × T_{DRX}
NOTE: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length.		

8.1.2.3 Measurement restrictions for SSB based RLM

The UE is required to be capable of measuring SSB for RLM without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

For FR1, when the SSB for RLM is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for RLM without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for RLM without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

For FR2, when the SSB for RLM measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for RLM and CSI-RS. Longer measurement period for SSB based RLM is expected, and no requirements are defined.

For FR2, there is no measurement restriction allowed when the network configures mixed numerology between SSB for RLM measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, provided that UE is capable of independent beam management on this FR2 band pair.

8.1.3 Requirements for CSI-RS based radio link monitoring

8.1.3.1 Introduction

The requirements in this clause apply for each CSI-RS based RLM-RS resource configured for PCell or PSCell, provided that the CSI-RS configured for RLM is actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1.3.2. UE is not expected to perform radio link monitoring measurements on the CSI-RS configured as RLM-RS if the CSI-RS is not in the active TCI state of any CORESET configured in the UE active BWP.

Table 8.1.3.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	4dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	4dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1.3.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.1.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_out\_CSI-RS}$ ms period becomes worse than the threshold Q_{out_CSI-RS} within $T_{Evaluate\_out\_CSI-RS}$ ms evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_in\_CSI-RS}$ ms period becomes better than the threshold Q_{in_CSI-RS} within $T_{Evaluate\_in\_CSI-RS}$ ms evaluation period.

- $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ are defined in Table 8.1.3.2-1 for FR1.
- $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ are defined in Table 8.1.3.2-2 for FR2 with scaling factor N=1.

The requirements of $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ apply provided that the CSI-RS for RLM is not in a resource set configured with repetition ON. The requirements do not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for RLM and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, and these measurement gaps are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when the RLM-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the RLM-RS resource is not overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- $P = P_{sharing\ factor}$, when the RLM-RS resource is not overlapped with measurement gap and RLM-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{\text{sharing factor}}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(MGRP, T_{SMTCperiod})}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- $P = \frac{P_{\text{sharing factor}}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the RLM-RS resource is partially overlapped with measurement gap and the RLM-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

- $P_{sharing\ factor}$ = 1, if the RLM-RS resource outside measurement gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and,

  - not overlapped by the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{sharing\ factor}$ = 3, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

Note: The overlap between CSI-RS for RLM and SMTC means that CSI-RS based RLM is within the SMTC window duration.

Longer evaluation period would be expected if the combination of RLM-RS resource, SMTC occasion and measurement gap configurations does not meet previous conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{out} and M_{in} used in Table 8.1.3.2-1 and Table 8.1.3.2-2 are defined as:

- M_{out} = 20 and M_{in} = 10, if the CSI-RS resource configured for RLM is transmitted with higher layer CSI-RS parameter *density* [6, clause 7.4.1] set to 3 and over the bandwidth ⩾ 24 PRBs.

Table 8.1.3.2-1: Evaluation period $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ for FR1

Configuration	$T_{Evaluate\_out\_CSI-RS}$ (ms)	$T_{Evaluate\_in\_CSI-RS}$ (ms)
no DRX	Max(200, Ceil(M_{out}×P)×T_{CSI-RS})	Max(100, Ceil(M_{in}×P) × T_{CSI-RS})
DRX ⩽ 320ms	Max(200, Ceil(1.5×M_{out}×P)× Max(T_{DRX}, T_{CSI-RS}))	Max(100, Ceil(1.5×M_{in}×P)× Max(T_{DRX}, T_{CSI-RS}))
DRX > 320ms	Ceil(M_{out}×P) × T_{DRX}	Ceil(M_{in}×P) × T_{DRX}
NOTE: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.		

Table 8.1.3.2-2: Evaluation period $T_{Evaluate\_out\_CSI-RS}$ and $T_{Evaluate\_in\_CSI-RS}$ for FR2

Configuration	$T_{Evaluate\_out\_CSI-RS}$ (ms)	$T_{Evaluate\_in\_CSI-RS}$ (ms)
no DRX	Max(200, Ceil(M_{out}×P×N)×T_{CSI-RS})	Max(100, Ceil(M_{in}×P×N) × T_{CSI-RS})
DRX ⩽ 320ms	Max(200, Ceil(1.5×M_{out}×P×N)× Max(T_{DRX}, T_{CSI-RS}))	Max(100, Ceil(1.5×M_{in}×P×N)× Max(T_{DRX}, T_{CSI-RS}))
DRX > 320ms	Ceil(M_{out}×P×N) × T_{DRX}	Ceil(M_{in}×P×N) × T_{DRX}
NOTE: T_{CSI-RS} is the periodicity of the CSI-RS resource configured for RLM. The requirements in this table apply for T_{CSI-RS} equal to 5 ms, 10 ms, 20 ms or 40 ms. T_{DRX} is the DRX cycle length.		

8.1.3.3 Measurement restrictions for CSI-RS based RLM

The UE is required to be capable of measuring CSI-RS for RLM without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following clauses.

For both FR1 and FR2, when the CSI-RS for RLM is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for RLM in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD, or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for RLM, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS for RLM measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR1, when the CSI-RS for RLM is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for RLM without any restriction.

For FR2, when the CSI-RS for RLM measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for RLM and SSB. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.

For FR2, when the CSI-RS for RLM measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for RLM and the other CSI-RS. Longer measurement period for CSI-RS based RLM is expected, and no requirements are defined.
  - The CSI-RS for RLM or the other CSI-RS in a resource set configured with repetition ON, or
  - The other CSI-RS is configured in q1 and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for RLM without any restriction.

8.1.4 Minimum requirement at transitions

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each RLM-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each RLM-RS resource. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of RLM resources to a second configuration of RLM resources that is different from the first configuration, for each RLM resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each RLM resource present in the second configuration. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of active TCI state of the CORESET to a second configuration of active TCI state of the CORESET, for each CSI-RS for RLM present in the second configuration, the UE shall use an evaluation period corresponding to the second configuration from the time of transition. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

8.1.5 Minimum requirement for UE turning off the transmitter

The transmitter power of the UE in the monitored cell shall be turned off within 40ms after expiry of T310 timer as specified in TS 38.331 [2].

8.1.6 Minimum requirement for L1 indication

When the downlink radio link quality on all the configured RLM-RS resources is worse than Q_{out}, layer 1 of the UE shall send an out-of-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331 [2].

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than Q_{in}, layer 1 of the UE shall send an in-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [2].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication\_interval}$.

When DRX is not used $T_{Indication\_interval}$ is max(10ms, $T_{RLM-RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in clause 8.1.2 if the RLM-RS resource is SSB, or T_{CSI-RS} specified in clause 8.1.3 if the RLM-RS resource is CSI-RS.

In case DRX is used, $T_{Indication\_interval}$ is Max(10ms, 1.5 × DRX_cycle_length, 1.5 × $T_{RLM-RS,M}$)) if DRX cycle_length is less than or equal to 320ms, and $T_{Indication\_interval}$ is DRX_cycle_length if DRX cycle_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

8.1.7 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM has different subcarrier spacing than PDSCH/PDCCH or is on frequency range 2, there are restrictions on the scheduling availability as described in the following clauses.

8.1.7.1 Scheduling availability of UE performing radio link monitoring with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH on FR1.

8.1.7.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM -RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

When intra-band carrier aggregation in FR1 is performed, the scheduling restrictions on FR1 serving PCell or PSCell applies to all serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols. When inter-band carrier aggregation within FR1 is performed, there are no scheduling restrictions on FR1 serving cell(s) in the bands due to radio link monitoring performed on FR1 serving PCell or PSCell in different bands.

8.1.7.3 Scheduling availability of UE performing radio link monitoring on FR2

The following scheduling restriction applies due to radio link monitoring on an FR2 serving PCell and/or PSCell.

- If the RLM-RS is CSI-RS which is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON,
    - There are no scheduling restrictions due to radio link monitoring based on the CSI-RS.
- Otherwise
    - The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on RLM-RS symbols to be measured for radio link monitoring.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions on FR2 serving PCell or PSCell applies to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cell(s) in the bands due to radio link monitoring performed on FR2 serving PCell or PSCell in different bands, provided that UE is capable of independent beam management on this FR2 band pair.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,

- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 3, UE is expected to receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for RLM; and

For the SSB for RLM and CORESET for RMSI scheduling multiplexing patterns 2, UE is expected to receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for RLM.

8.1.7.4 Scheduling availability of UE performing radio link monitoring on FR1 or FR2 in case of FR1-FR2 inter-band CA and NR-DC

There are no scheduling restrictions on FR1 serving cell(s) due to radio link monitoring performed on FR2 serving PCell and/or PSCell.

There are no scheduling restrictions on FR2 serving cell(s) due to radio link monitoring performed on FR1 serving PCell and/or PSCell.

8.1A Radio Link Monitoring with CCA on Target Frequency

8.1A.1 Introduction

The requirements in clause 8.1A apply for radio link monitoring on a carrier frequency with CCA for cells:

- PCell in SA NR operation mode,
- PSCell in EN-DC operation mode.

The UE shall monitor the downlink radio link quality based on the reference signal configured as RLM-RS resource(s) in order to detect the downlink radio link quality of the PCell and PSCell as specified in TS 38.213 [3]. The configured RLM-RS resources can be all SSBs, or all CSI-RSs, or a mix of SSBs and CSI-RSs. UE is not required to perform RLM outside the active DL BWP.

On each RLM-RS resource, the UE shall estimate the downlink radio link quality and compare it to the thresholds $Q_{out,CCA}$ and $Q_{in,CCA}$ for the purpose of monitoring downlink radio link quality of the cell.

The threshold $Q_{out,CCA}$ is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to the out-of-sync block error rate ($BLER_{out,CCA}$) as defined in Table 8.1A.1-1. For SSB based radio link monitoring, $Q_{out\_SSB,CCA}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1A.2.1-1.

The threshold $Q_{in,CCA}$ is defined as the level at which the downlink radio link quality can be received with significantly higher reliability than at $Q_{out,CCA}$ and shall correspond to the in-sync block error rate ($BLER_{in}$) as defined in Table 8.1A.1-1. For SSB based radio link monitoring, $Q_{in\_SSB,CCA}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.1A.2.1-2.

The out-of-sync block error rate ($BLER_{out,CCA}$) and in-sync block error rate ($BLER_{in,CCA}$) are determined from the network configuration via parameter *rlmInSyncOutOfSyncThreshold* signalled by higher layers. When UE is not configured with *rlmInSyncOutOfSyncThreshold* from the network, UE determines out-of-sync and in-sync block error rates from Configuration #0 in Table 8.1A.1-1 as default. All requirements in clause 8.1A are applicable for BLER Configuration #0 in Table 8.1A.1-1.

Table 8.1A.1-1: Out-of-sync and in-sync block error rates

Configuration	$BLER_{out,CCA}$	$BLER_{in,CCA}$
0	10%	2%

UE shall be able to monitor up to N_{RLM} RLM-RS resources of the same or different types in each corresponding carrier frequency range, depending on a maximum number L_{max} of SSBs per half frame according to TS 38.213 [3], where N_{RLM} is specified in Table 8.1A.1-2, and meet the requirements as specified in clause 8.1A. UE is not required to meet the requirements in clause 8.1A if RLM-RS is not configured and no TCI state for PDCCH is activated.

Table 8.1A.1-2: Maximum number of RLM-RS resources N_{RLM}

L_{max}	Maximum number of RLM-RS resources, N_{RLM}
8	4

In the requirements of clause 8.1A, the term RLM-RS SSB occasion not available at the UE refers to when the RLM-RS SSB is configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the set of configured RLM-RS resources are not available at the UE due to DL CCA failures at gNB during the corresponding evaluation period; otherwise the RLM-RS SSB is considered as available at the UE.

8.1A.2 Requirements for SSB Based Radio Link Monitoring

8.1A.2.1 Introduction

The requirements in this clause apply for each SSB based RLM-RS resource configured for PCell or PSCell, provided that the SSB configured for RLM are actually configured to be transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.1A.2.2 but occasionally may be not transmitted due to CCA operation.

Table 8.1A.2.1-1: PDCCH transmission parameters for out-of-sync evaluation

Attribute	Value for BLER Configuration #0
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	4 dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	4 dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

Table 8.1A.2.1-2: PDCCH transmission parameters for in-sync evaluation

Attribute	Value for BLER Configuration #0
DCI payload size	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	4
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.1A.2.2 Minimum Requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_out\_SSB,CCA}$ [ms] period becomes worse than the threshold $Q_{out\_SSB,CCA}$ within $T_{Evaluate\_out\_SSB,CCA}$ [ms] evaluation period.

UE shall be able to evaluate whether the downlink radio link quality on the configured RLM-RS resource estimated over the last $T_{Evaluate\_in\_SSB,CCA}$ [ms] period becomes better than the threshold $Q_{in\_SSB,CCA}$ within $T_{Evaluate\_in\_SSB,CCA}$ [ms] evaluation period.

$T_{Evaluate\_out\_SSB,CCA}$ and $T_{Evaluate\_in\_SSB,CCA}$ are defined in Table 8.1A.2.2-1, where

- $P = \frac{1}{1-\frac{T_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, and these measurement gaps are overlapping with some but not all occasions of the SSB RLM-RS resources; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB RLM-RS resources.

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*.

Longer evaluation period would be expected if the combination of RLM-RS, SMTC occasion, and measurement gap configurations does not meet previous conditions.

Table 8.1A.2.2-1: Evaluation period $T_{Evaluate\_out\_SSB,CCA}$ and $T_{Evaluate\_in\_SSB,CCA}$

Configuration	$T_{Evaluate\_out\_SSB,CCA}$ (ms)		$T_{Evaluate\_in\_SSB,CCA}$ (ms)
	RLM-RS SSB Es/Iot[Note4] ≥-7 dB	RLM-RS SSB Es/Iot [Note4] <-7 dB	
no DRX	Max(200, Ceil(17*P)*T_{SSB})	Max(200, Ceil(24*P)*T_{SSB})	Max(100, Ceil((5+L_{in})*P)*T_{SSB})
DRX cycle≤ 320	Max(200, Ceil(1.5*15*P)*Max(T_{DRX},T_{SSB}))	Max(200, Ceil(1.5*20*P)*Max(T_{DRX},T_{SSB}))	Max(100, Ceil(1.5*(5+L_{in})*P)*Max(T_{DRX},T_{SSB}))
DRX cycle>320	Ceil(13*P)*T_{DRX}	Ceil(16*P)*T_{DRX}	Ceil((5+L_{in})*P)*T_{DRX}
NOTE 1: T_{SSB} is the periodicity of the SSB configured for RLM. T_{DRX} is the DRX cycle length. NOTE 2: L_{in} is the number of RLM-RS SSB occasions which are not available at the UE during $T_{Evaluate\_in\_SSB,CCA}$, where $L_{in} \le L_{in,max}$. NOTE 3: $L_{in,max}$=7 for Max(T_{DRX},T_{SSB}) ≤ 40 assuming T_{DRX}=0 for non-DRX case, $L_{in,max}$=5 for 40<Max(T_{DRX},T_{SSB})≤320, $L_{in,max}$=3 for T_{DRX}>320. NOTE 4: RLM-RS SSB Es/Iot is the averaged Es/Iot over the most recent previous out-of-sync evaluation period.			

8.1A.2.3 Measurement Restrictions for SSB based RLM

The UE is required to be capable of measuring SSB for RLM without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following clauses.

When the SSB for RLM is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for RLM without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for RLM without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure SSB for RLM.

8.1A.3 Minimum requirement at transitions

When the UE transitions between DRX and no DRX or when DRX cycle periodicity changes, for each RLM-RS resource, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation period corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode for each RLM-RS resource. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of RLM resources to a second configuration of RLM resources that is different from the first configuration, for each RLM resource present in the second configuration, for a duration of time equal to the evaluation period corresponding to the second configuration after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first configuration and the second configuration. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second configuration for each RLM resource present in the second configuration. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

When the UE transitions from a first configuration of active TCI state of the CORESET to a second configuration of active TCI state of the CORESET, for each CSI-RS for RLM present in the second configuration, the UE shall use an evaluation period corresponding to the second configuration from the time of transition. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the monitored cell.

8.1A.4 Minimum requirement for UE turning off the transmitter

The transmitter power of the UE in the monitored cell shall be turned off within 40ms after expiry of T310 timer as specified in TS 38.331 [2]. The UE shall not perform CCA procedure on any of the serving carrier frequencies with CCA after the expiry of T310.

8.1A.5 Minimum requirement for L1 indication

When the downlink radio link quality on all the configured RLM-RS resources is worse than $Q_{out,CCA}$, layer 1 of the UE shall send an out-of-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the out-of-sync indications as specified in TS 38.331 [2].

When the downlink radio link quality on at least one of the configured RLM-RS resources is better than $Q_{in,CCA}$, layer 1 of the UE shall send an in-sync indication for the cell to the higher layers. A layer 3 filter shall be applied to the in-sync indications as specified in TS 38.331 [2].

The out-of-sync and in-sync evaluations for the configured RLM-RS resources shall be performed as specified in clause 5 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication\_interval,CCA}$.

When DRX is not used $T_{Indication\_interval,CCA}$ is max(10ms, $T_{RLM-RS,M}$), where $T_{RLM,M}$ is the shortest periodicity of all configured RLM-RS resources for the monitored cell, which corresponds to T_{SSB} specified in clause 8.1A.2 if the RLM-RS resource is SSB.

In case DRX is used, $T_{Indication\_interval,CCA}$ is Max(10ms, 1.5 × DRX_cycle_length, 1.5 × $T_{RLM-RS,M}$)) if DRX cycle_length is less than or equal to 320ms, and $T_{Indication\_interval,CCA}$ is DRX_cycle_length if DRX cycle_length is greater than 320ms. Upon start of T310 timer as specified in TS 38.331 [2], the UE shall monitor the configured RLM-RS resources for recovery using the evaluation period and layer 1 indication interval corresponding to the no DRX mode until the expiry or stop of T310 timer.

8.1A.6 Scheduling availability of UE during radio link monitoring

When the reference signal to be measured for RLM on a carrier frequency with CCA has different subcarrier spacing than PDSCH/PDCCH, there are restrictions on the scheduling availability as described in the following clauses.

8.1A.6.1 Scheduling availability of UE performing radio link monitoring with the same subcarrier spacing as PDSCH/PDCCH

There are no scheduling restrictions due to radio link monitoring performed with a same subcarrier spacing as PDSCH/PDCCH.

8.1A.6.2 Scheduling availability of UE performing radio link monitoring with a different subcarrier spacing than PDSCH/PDCCH

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to radio link monitoring based on SSB as RLM-RS. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to radio link monitoring based on SSB as RLM -RS.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for radio link monitoring.

When intra-band carrier aggregation is performed, the scheduling restrictions on PCell or PSCell applies to all serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols.

8.2 Interruption

8.2.1 EN-DC Interruption

8.2.1.1 Introduction

This clause contains the requirements related to the interruptions on PSCell, and SCell, when

E-UTRA PCell transitions between active and non-active during DRX, or

E-UTRA PCell transitions from non-DRX to DRX, or

E-UTRA SCell in MCG or SCell in SCG is added or released, or

E-UTRA SCell in MCG or SCell(s) in SCG is activated or deactivated, or

measurements on SCC with deactivated SCell in either E-UTRA MCG or NR SCG, or

a supplementary UL carrier or an UL carrier is configured or de-configured, or

UL/DL BWP is switched on PSCell or SCell in SCG, or

UE-specific CBW is changed on PSCell or SCell in SCG, or

CGI reading of an NR neighbour cell with autonomous gaps, or

CGI reading of an E-UTRA neighbour cell with autonomous gaps.

NR SRS carrier based switching, or

E-UTRA SRS carrier based switching, or

UE dynamic Tx switches between two uplink carriers.

The requirements shall apply for E-UTRA-NR DC with an E-UTRA PCell.

This clause contains interruptions where victim cell is PSCell or SCell belonging to SCG. Requirements for interruptions requirements when the victim cell is E-UTRA PCell or E-UTRA SCell belonging to MCG are specified in TS 36.133 [15].

For a UE which does not support per-FR measurement gaps, interruptions to the PSCell or activated SCG SCells may be caused by EUTRA PCell, EUTRA SCells or SCells on any frequency range. For UE which support per-FR gaps, interruptions to the PSCell or activated SCG SCells may be caused by EUTRA PCell, EUTRA SCells or SCells on the same frequency range as the victim cell.

8.2.1.2 Requirements

8.2.1.2.1 Interruptions at transitions between active and non-active during DRX

Interruption on PSCell and the activated SCell if configured due to E-UTRA PCell transitions between active and non-active druing DRX when PSCell or SCell is in non-DRX are allowed with up to 1% probability of missed ACK/NACK when the configured E-UTRA PCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured E-UTRA PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slot as defined in table 8.2.1.2.1-1.

Table 8.2.1.2.1-1: Interruption length X at transition between active and non-active during DRX

μ	NR Slot length (ms)	Interruption length X (slots)	
		Sync	Async
0	1	1	2
1	0.5	1	2
2	0.25	3	
3	0.125	5	

When both E-UTRA PCell and PSCell are in DRX, no interruption is allowed.

8.2.1.2.2 Interruptions at transitions from non-DRX to DRX

Interruption on PSCell and the activated SCell if configured due to E-UTRA PCell transitions from non-DRX to DRX when PSCell or SCell is in non-DRX shall not exceed X slot as defined in table 8.2.1.2.1-1.

When PSCell and the activated SCell are in DRX, no interruption due to E-UTRA PCell transitions from non-DRX to DRX is allowed.

8.2.1.2.3 Interruptions at SCell addition/release

The requirements in this clause shall apply for the UE configured with PSCell.

When one E-UTRA SCell in MCG is added or released:

- the UE is allowed an interruption on any active serving cell in SCG:
    - of up to X1 slot, if the active serving cell is not in the same band as any of the E-UTRA SCells being added or released, or
    - of up to max{Y1 slot + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being added or released, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being added or released are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above active serving cells in SCG;

    Where X1 and Y1 are specified in Table 8.2.1.2.3-1.

When one SCell in SCG is added or released:

- the UE is allowed an interruption on any active serving cell in SCG:
    - of up to X1 slot, if the active serving cell and the SCell being added or released are in a FR1 band pair or in a FR1+FR2 band pair.
    - of up to X1 slot, if the active serving cell and the SCell being added or released are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair

    or

    - of up to Y1 slot + $T_{SMTC\_duration}$ if the active serving cells are in the same band as any of the SCells being added or released, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot, where, $T_{SMTC\_duration}$ is
        - the longest SMTC duration among all above active serving cells in SCG and the SCell being added when one SCell is added;
        - the longest SMTC duration among all above active serving cells in SCG when one SCell is released.

    Where X1 and Y1 are specified in Table 8.2.1.2.3-2.

Table 8.2.1.2.3-1: Interruption length X1 and Y1 at E-UTRA SCell addition/Release

μ	NR Slot length (ms)	Interruption length X1 (slots)		Interruption length Y1 (slots)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	2	3	2	3
2	0.25	5		4	5
3	0.125	9		N/A	- N/A

Table 8.2.1.2.3-2: Interruption length X1 and Y1 at SCell addition/Release

<table>
<tr><th>μ</th><th>NR Slot length (ms) of victim cell</th><th colspan="2">Interruption length X1 (slots)</th><th>Interruption length Y1 (slots)</th></tr>
<tr><td>0</td><td>1</td><td colspan="2">1</td><td>1</td></tr>
<tr><td>1</td><td>0.5</td><td colspan="2">2</td><td>2</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">0.25</td><td>Both aggressor cell and victim cell are on FR2</td><td>4</td><td rowspan="2">4</td></tr>
<tr><td>Either aggressor cell or victim cell is on FR1</td><td>5</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">0.125</td><td>Aggressor cell is on FR2</td><td>8</td><td rowspan="2">8</td></tr>
<tr><td>Aggressor cell is on FR1</td><td>9</td></tr>
</table>

8.2.1.2.4 Interruptions at SCell activation/deactivation

The requirements in this clause shall apply for the UE configured with PSCell and one SCell.

When one E-UTRA SCell in MCG is activated from deactivated or dormant state, or deactivated from activated or dormant state:

- the UE is allowed an interruption on any active serving cell in SCG:
  - of up to X2 slot, if the active serving cell is not in the same band as any of the E-UTRA SCells being activated or deactivated, or
  - of up to max{Y2 slot + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being activated or deactivated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being activated or deactivated are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above active serving cells in SCG.

    Where X2 and Y2 are specified in Table 8.2.1.2.4-1.

When one SCell in SCG is activated or deactivated:

- an interruption on any serving cell in SCG:
  - of up to X2 slot, if the active serving cell and the SCell being activated or deactivated are in a FR1 band pair or in a FR1+FR2 band pair.
  - of up to X2 slot, if the active serving cells and the SCells being activated or deactivated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

  or

  - of up to Y2 slot + $T_{SMTC\_duration}$ if the active serving cells are in the same band as any of the SCells being activated or deactivated, provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot, where, $T_{SMTC\_duration}$ is
    - the longest SMTC duration among all above active serving cells in SCG and the SCell being activated when one SCell is activated;
    - the longest SMTC duration among all above active serving cells in SCG when one SCell is deactivated.

  Where X2 and Y2 are specified in Table 8.2.1.2.4-2.

Table 8.2.1.2.4-1: Interruption length X2 and Y2 at E-UTRA SCell activation/deactivation

μ	NR Slot length (ms)	nterruption length X2 (slots)		Interruption length Y2 (slots)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	1	2	1	2
2	0.25	3		2	3
3	0.125	5		N/A	N/A

Table 8.2.1.2.4-2: Interruption length X2 and Y2 at SCell activation/deactivation

μ	NR Slot length (ms) of victim cell	Interruption length X2 (slots)		Interruption length Y2 (slots)
0	1	1		1
1	0.5	1		1
2	0.25	Both aggressor cell and victim cell are on FR2	2	2
		Either aggressor cell or victim cell is on FR1	3	
3	0.125	Aggressor cell is on FR2	4	4
		Aggressor cell is on FR1	5	

8.2.1.2.5 Interruptions during measurements on SCC

8.2.1.2.5.1 Interruptions during measurements on deactivated NR SCC

Interruption on PSCell and other activated NR SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 8.2.2.2.3, where the term PCell in clause 8.2.2.2.3 shall be deemed to be replaced with PSCell.

8.2.1.2.5.2 Interruptions during measurements on deactivated E-UTRAN SCC

When one E-UTRA SCell in MCG is deactivated, the UE is allowed due to measurements on the E-UTRA SCC with the deactivated E-UTRA SCell:

- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK when any of the configured *measCycleSCell* [15] for the deactivated E-UTRA SCells is 640 ms or longer.
- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [15] for the deactivated E-UTRA SCells if indicated by the network using IE *allowInterruptions* [15].

Each interruption shall not exceed

- X3 slot, if the PSCell or activated SCell is not in the same band as the E-UTRA deactivated SCC being measured, or
- Y3 slot + SMTC duration, if the PSCell or activated SCell is in the same band as the E-UTRA deactivated SCC being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA deactivated SCC being measured are available in the same slot.

Table 8.2.1.2.5.2-1: Interruption length X3 and Y3 at measurements on deactivated E-UTRA SCC

μ	NR Slot length (ms)	Interruption length X3 (slots)		Interruption length Y3 (slots)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	1	2	1	2
2	0.25	3		2	3
3	0.125	5		N/A	N/A

8.2.1.2.5.3 Interruptions during CQI measurements on dormant E-UTRAN SCell

When one E-UTRA SCell in MCG is dormant, the UE is allowed due to CQI measurements on the dormant E-UTRA SCell:

- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK.

Each interruption shall not exceed

- X3 slot, if the PSCell or activated SCell is not in the same band as the E-UTRA dormant SCell being measured, or
- Y3 slot + SMTC duration, if the PSCell or activated SCell is in the same band as the E-UTRA dormant SCell being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA dormant SCell being measured are available in the same slot.

Where X3 and Y3 are defined in Table 8.2.1.2.5.2-1.

8.2.1.2.5.4 Interruptions during RRM measurements on dormant E-UTRAN SCC

When one E-UTRA SCell in MCG is dormant, the UE is allowed due to RRM measurements on the E-UTRA SCC with the dormant E-UTRA SCell:

- an interruption on PSCell or any activated SCell with up to 0.5% probability of missed ACK/NACK.

Each interruption shall not exceed

- X3 slot, if the PSCell or activated SCell is not in the same band as the E-UTRA dormant SCC being measured, or
- Y3 slot + SMTC duration, if the PSCell or activated SCell is in the same band as the E-UTRA dormant SCC being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA dormant SCC being measured are available in the same slot.

Where X3 and Y3 are defined in Table 8.2.1.2.5.2-1.

8.2.1.2.6 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR non-standalone operation as defined in TS 38.331 [2].

When an UL carrier or supplementary UL carrier is configured or de-configured, an interruption of up to X4 slot, is allowed during the RRC reconfiguration procedure [2] on E-UTRA PCell, all activated E-UTRA SCells, PSCell and all activated SCells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of E-UTRA PCell, all activated E-UTRA SCells, PSCell and all activated SCells within the same FR as the configured or de-configured UL.

Table 8.2.1.2.6-1: Interruption length X4 at UL carrier RRC reconfiguration

μ	NR Slot length (ms)	Interruption length X4 (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	
3	0.125	9	

8.2.1.2.7 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch or UL BWP switch triggered by consistent uplink LBT failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in Table 8.2.1.2.7-2, the UE is allowed to cause interruption of up to X slot to other active serving cells if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.1.2.7-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ as defined in clause 8.6.2A.1 when BWP switch occurs on multiple CCs. Interruptions are not allowed during BWP switch involving any other parameter change.

When a BWP timer *bwp-InactivityTimer* defined in TS 38.331 [2] expires, UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in Table 8.2.1.2.7-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.1.2.7-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.1.2.7-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ as defined in clause 8.6.2B.1 when BWP switch occurs on multiple CCs simultaneously or $T_{MultipleBWPswitchDelayTotal}$ as defined in clause 8.6.2B.2 when BWP switch occurs on multiple CCs over partially overlapping time period. Interruptions are not allowed during BWP switch involving any other parameter change.. Interruptions are not allowed during BWP switch involving any other parameter change.

When UE receives an RRC reconfiguration that only requests UE to switch its active BWP on one single CC, the UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in Table 8.2.1.2.7-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.1.2.7-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.1.2.7-1. The interruption is only allowed within the delay $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}$ defined in clause 8.6.3 when BWP switch occurs on a single CC.

When UL BWP switch is triggered by consistent uplink LBT failures [7], the UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active UL BWP involving changes in any of the parameters listed in Table 8.2.1.2.7-2 if the UE is not capable of per-FR gap, or if the UL BWP switching involves SCS changing. When the UL BWP switch imposes changes in any of the parameters listed in Table 8.2.1.2.7-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing UL BWP switching. X is defined in Table 8.2.1.2.7-1. The starting time of interruption is only allowed within the UL BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2. Interruptions are not allowed during UL BWP switch involving other parameter change.

Table 8.2.1.2.7-1: interruption length X

μ	NR Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1
2	0.25	3
3	0.125	5
Note1: void		

Table 8.2.1.2.7-2: Parameters which cause interruption other than SCS

Parameters	Comment
locationAndBandwidth	From TS 38.331 [2]
nrofSRS-Ports	
maxMIMO-Layers-r16	

8.2.1.2.8 Interruptions at direct SCell activation and hibernation

8.2.1.2.8.1 Interruptions during direct SCell activation and hibernation of E-UTRA SCell

When one E-UTRA SCell in MCG is directly activated and hibernated:

- the UE is allowed an interruption on any active serving cell in SCG:
  - of up to X1 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being directly activated or hibernated, or
  - of up to max{Y1 slots + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being directly activated or hibernated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being directly activated or hibernated are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above active serving cells in MCG Where X1 and Y1 are specified in Table 8.2.1.2.3-1.

8.2.1.2.8.2 Interruptions during direct SCell activation

When one or multiple SCell(s) in SCG are directly activated at SCell addition:

- the UE is allowed an interruption on any active serving cell in SCG:
  - of up to X1 slot, if the active serving cell is not in the same band as the SCell being directly activated, or
  - of up to max{Y1 slot + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as the SCell being directly activated, provided the cell specific reference signals from the active serving cells and the SCell being directly activated are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above active serving cells in SCG.

  Where X1 and Y1 are specified in Table 8.2.1.2.3-2.

8.2.1.2.9 Interruptions at SCell hibernation

When one E-UTRA SCell in MCG is hibernated:

- the UE is allowed an interruption on any active serving cell in SCG:
  - of up to X2 slots, if the active serving cell is not in the same band as any of the E-UTRA SCells being hibernated, or
  - of up to max{Y2 slots + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being hibernated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being hibernated are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above active serving cells in MCG.

  Where X2 and Y2 are specified in Table 8.2.1.2.4-1.

8.2.1.2.10 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with PSCell and up to 6 downlink SCell(s).

When multiple SCells in SCG are activated or deactivated by one single MAC CE command:

- an interruption on any serving cell in SCG is specified as in clause 8.2.1.2.4.

8.2.1.2.11 Interruptions due to UE-specific CBW change

When UE receives an RRC reconfiguration that changes *offsetToCarrier* or *carrierBandwidth*, the UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its CBW. X is defined in Table 8.2.1.2.11-1. The interruption is only allowed within the delay $T_{RRCprocessingDelay}$ + $T_{CBWchangeDelayRRC}$ defined in clause 8.7.

Table 8.2.1.2.11-1: interruption length X

μ	NR Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1
2	0.25	3
3	0.125	5

8.2.1.2.12 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to an active UL BWP of another activated carrier;
- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;
- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS38.331 [2];
- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26].
- the SRS switching is not colliding with any measurements in SCG.
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101 [5], the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.1.2.12-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR2 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.1.2.12-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.1.2.12-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR2 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.1.2.12-2.

Table 8.2.1.2.12-1: Interruption length X1 (slot)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us) Note 1	Interruption length X1 (slots) Sub carrier spacing for agressor cell (kHz)	
			15	30
0	1	≤ 200	2	2
		300, 500	2	2
		900	3	3
1	0.5	≤ 200	3	2
		300, 500	3	3
		900	4	4
2	0.25	≤ 200	4	3
		300, 500	5	4
		900	7	6
3	0.125	≤ 200	7	5
		300, 500	9	7
		900	12	10
Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

Table 8.2.1.2.12-2: Interruption length X2 (slot)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us) Note	Interruption length X2 (slots) Sub carrier spacing for agressor cell (kHz)	
			60	120
0	1	$\leq$ 200	2	2
1	0.5	$\leq$ 200	2	2
2	0.25	$\leq$ 200	3	3
3	0.125	$\leq$ 200	4	4

For intra-band SRS carrier switching in FR1 or FR2, interruptions in Table 8.2.1.2.12-1 and in Table 8.2.1.2.12-2 based on SRS carrier switching time $\leq$ 200us shall apply. For inter-band SRS carrier switching in FR1 or between FR1 and FR2, interruptions in Table 8.2.1.2.12-1 and in Table 8.2.1.2.12-2 shall apply.

8.2.1.2.13 Interruptions at E-UTRA SRS carrier based switching

A PUSCH-less carrier of SCell is a TDD carrier without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [23] and/or non-contention based PRACH on a PUSCH-less carrier of SCell, the UE can perform carrier based switching to one or more PUSCH-less carrier of SCells from a carrier with PUSCH or from another PUSCH-less carrier of SCell prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured carrier to another activated TDD carrier;
- the PUSCH-less carrier of SCells to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [15] for periodic SRS transmission;
- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [15];
- the SRS switching is not colliding with any other transmission with higher priority defined in TS36.213 [TBD];
- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in TS36.213 [TBD];
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without

simultaneous Rx/Tx specified in TS 36.101 [25], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of Per-FR gap, during the switching to the PUSCH-less carrier of a serving cell,

- with up to X3 slot as specified in Table 8.2.1.2.13-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in SCG if UE is not capable of Per-FR gap, or on active serving cell(s) in SCG in FR1 if UE is capable of Per-FR gap, during the switching from the PUSCH-less carrier of a serving cell,

- with up to X3 slot as specified in Table 8.2.1.2.13-1

Table 8.2.1.2.13-1: Interruption length X3 (slot)

μ	NR Slot length (ms)	Interruption length X3 (slots)
0	1	2
1	0.5	3
2	0.25	5

8.2.1.2.14 DL Interruptions at switching between two uplink carriers

The DL interruption requirements at dynamic switching between two uplink carriers specified in this clause are applicable for an uplink band pair of an inter-band EN-DC configuration when the capability *uplinkTxSwitchingPeriod* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [26], where E-UTRA UL carrier is capable of one transmit antenna connector and NR UL carrier is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

When dynamic switching between two uplink carriers is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period located in NR carrier. The DL interruption lengths of X for NR carrier(s) are defined in Table 8.2.1.2.14-1.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band EN-DC configurations as specified in clause 5.5B.4 of TS 38.101-3 [20].

Table 8.2.1.2.14-1: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching between two uplink carriers

μ	NR Slot length (ms)	Uplink Tx switching period Note1	
		35us	140us
0	1	2	3
1	0.5	3	6
2	0.25	4	10
Note 1: Uplink Tx switching period depends on UE capability *uplinkTxSwitchingPeriod.*			

8.2.1.2.15 Interruptions due to SCell dormancy

8.2.1.2.15.1 Interruptions due to SCell dormancy switch

When one SCell in SCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in SCG as defined in clause 8.2.1.2.7, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP

- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in SCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.1.2.15.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5%.

8.2.1.2.15.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed [1.0]%.

8.2.1.2.16 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PSCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in Table 8.2.1.2.16-1 for each interruption during MIB decoding time period T_{MIB} specified in clause 9.11.

- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in Table 8.2.1.2.16-1 during SIB1 decoding time period T_{SIB1} specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.

- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in Table 8.2.1.2.16-1 during SIB1 decoding time period T_{SIB1} specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and

- L1 = 6 x N, where N =1 if $T_{SMTC} \leq 20$ms, or N = T_{SMTC} / 20ms if $T_{SMTC} > 20$ms. T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier, and

- L2 = 6.

Table 8.2.1.2.16-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10
2	0.25	24	25	19
3	0.125	48	49	37

8.2.1.2.17 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period

- $T_{identify\_CGI,\ intra}$ specified in clause 8.1.2.2.3, or clause 8.1.2.2.4 in TS 36.133 [15], or
- $T_{identify\_CGI,\ inter}$ specified in clause 8.1.2.3.5, or clause 8.1.2.3.6, or clause 8.1.2.3.7, or clause 8.1.2.3.6 in TS 36.133 [15], or
- $T_{identify\_CGI,\ E\text{-}UTRA}$ specified in clause 9.4.7.1

the UE shall be able to transmit at least the number of ACK/NACKs specified in Table 8.2.1.2.17-1 on PSCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured.

Table 8.2.1.2.17-1: Minimum number of ACK/NACKs transmitted by the UE

Minimum number of transmitted ACK/NACKs	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

8.2.2 SA: Interruptions with Standalone NR Carrier Aggregation

8.2.2.1 Introduction

This clause contains the requirements related to the interruptions on PCell and activated SCell if configured, when

up to 7 SCells are configured, de-configured, activated or deactivated, or

a supplementary UL carrier or an UL carrier is configured or de-configured, or

measurements on SCC with deactivated SCell in NR SCG, or

UL/DL BWP is switched on PCell or SCell, or

CGI reading of an NR neighbour cell with autonomous gaps, or

CGI reading of an E-UTRA neighbour cell with autonomous gaps.

UE-specific CBW is changed on PCell or SCell, or

NR SRS carrier based switching, or

UE dynamic Tx switches between two uplink carriers.

Note: interruptions at SCell addition/release, activation/deactivation and during measurements on SCC may not be required by all UEs.

The interruptions shall not interrupt RRC signalling or ACK/NACKs related to RRC reconfiguration procedure according to TS38.331 [2] for SCell addition/release or MAC control signalling according to TS37.340 [17] for SCell activation/deactivation command.

This clause additionally contains requirements related to interruptions at inter-frequency SFTD between PCell in FR1 and neighbour cell in FR2.

For a UE which does not support per-FR measurement gap, interruptions to the PCell and activated SCell may be caused by SCells on any frequency range. For a UE which supports per-FR gaps, interruptions to PCell and activated SCell may be caused by SCells on the same frequency range as the victim cell.

In addition to standalone NR carrier aggregation when no CCA is configured, the requirements in clause 8.2.2. and all subclauses of 8.2.2 apply when the UE is configured with

-A PCell not using CCA in downlink and one or more SCells using CCA in downlink or

-A PCell and one or more SCells using CCA in downlink

8.2.2.2 Requirements

8.2.2.2.1 Interruptions at SCell addition/release

When any number of SCells between one and 7 is added or released using the same *RRCConnectionReconfiguration* message as defined in TS 38.331 [2], the UE is allowed an interruption on any active serving cell during the RRC reconfiguration procedure as follows:

- an interruption on any active serving cell:
  - of up to X1 slot, if the active serving cell and the SCell being added or released are in a FR2 band pair or are in a FR2 band pair.
  - of up to X1 slot, if the active serving cell and the SCell being added or released are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

    Where X1 is specified in Table 8.2.2.2.1-1.

  or

  - of up to the duration shown in table 8.2.2.2.1-2, if the active serving cells are in the same band as any of the SCells being added or released, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot.

Table 8.2.2.2.1-1: Interruption length X1 for SCell addition/release for inter-band CA

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	
0	1	1	
1	0.5	2	
2	0.25	Both aggressor cell and victim cell are on FR2	4
		Either aggressor cell or victim cell is on FR1	5
3	0.125	Aggressor cell is on FR2	8
		Aggressor cell is on FR1	9

Table 8.2.2.2.1-2: Interruption duration for SCell addition/release for intra-band CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
1	0.5	2 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
2	0.25	4 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
3	0.125	8 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
NOTE 1: $T_{SMTC\_duration}$ measured in subframes is - the longest SMTC duration among all above active serving cells and the SCell being added when one SCell is added; - the longest SMTC duration among all active serving cells in the same band when one SCell is released. NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].		

8.2.2.2.2 Interruptions at SCell activation/deactivation

When an intra-band SCell is activated or deactivated as defined in TS 37.340 [17], the UE is allowed

- an interruption on any active serving cell:
  - of up to X2 slot, if the active serving cell and the SCell being activated or deactivated are in a FR1 band pair or in a FR1+FR2 band pair.
  - of up to X2 slot, if the active serving cell and the SCell being activated or deactivated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

    Where X2 is specified in Table 8.2.2.2.2-1.

  or

  - of up to the duration shown in table 8.2.2.2.2-2, if the active serving cells are in the same band as any of the SCells being activated or deactivated provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot.

Table 8.2.2.2.2-1: Interruption length X2 for SCell activation/deactivation for inter-band CA

μ	NR Slot length (ms) of victim cell	Interruption length X2 (slots)	
0	1		1
1	0.5		1
2	0.25	Both aggressor cell and victim cell are on FR2	2
		Either aggressor cell or victim cell is on FR1	3
3	0.125	Aggressor cell is on FR2	4
		Aggressor cell is on FR1	5

Table 8.2.2.2.2-2: Interruption duration for SCell activation/deactivation for intra-band CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
1	0.5	1 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
2	0.25	2 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
3	0.125	4 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
NOTE 1: $T_{SMTC\_duration}$ measured in subframes is - the longest SMTC duration among all above active serving cells and the SCell being activated when one SCell is activated; - the longest SMTC duration among all active serving cells in the same band when one SCell is deactivated. NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].		

8.2.2.2.3 Interruptions during measurements on deactivated SCC

Interruptions on PCell due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 8.2.2.2.2-1 if the PCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 8.2.2.2.2-2 if the PCell is in the same band as the deactivated SCell.

Interruptions on activated SCells due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 8.2.2.2.2-1 if the activated SCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 8.2.2.2.2-2 if the activated SCell is in the same band as the deactivated SCell.

8.2.2.2.4 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR standalone carrier aggregation as defined in TS 38.331 [2].

When an UL carrier or supplementary UL carrier is configured or de-configured, an interruption of up to the duration shown in table 8.2.2.2.4-1, is allowed during the RRC reconfiguration procedure [2] on PCell and all activated SCells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of PCell and all the activated SCells within the same FR as the configured or de-configured UL.

Table 8.2.2.2.4-1: Interruption duration for UL carrier RRC reconfiguration

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1
1	0.5	2
2	0.25	4
3	0.125	8

8.2.2.2.5 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch or UL BWP switch triggered by consistent uplink LBT failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When UE receives a DCI indicating UE to switch its active BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2, the UE is allowed to cause interruption of up to X slot to other active serving cells if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2 and the UE is capable of per-FR gap the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.2.2.5-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ as defined in clause 8.6.2A.1 when BWP switch occurs on multiple CCs. Interruptions are not allowed during BWP switch involving any other parameter change.

When a BWP timer *bwp-InactivityTimer* defined in TS 38.331 [2] expires, UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.2.2.5-1. The starting time of interruption is only allowed within the BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2 when BWP switch occurs on a single CC. The starting time of interruption caused by each BWP switch is only allowed within the BWP switch delay $T_{MultipleBWPswitchDelay}$ as defined in clause 8.6.2B.1 when BWP switch occurs on multiple CCs simultaneously or $T_{MultipleBWPswitchDelayTotal}$ as defined in clause 8.6.2B.2 when BWP switch occurs on multiple CCs over partially overlapping time period. Interruptions are not allowed during BWP switch involving any other parameter change.

When UE receives an RRC reconfiguration that only requests UE to switch its active BWP on one single CC, the UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing BWP switching. X is defined in Table 8.2.2.2.5-1. The interruption is only allowed within the delay $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}$ defined in clause 8.6.3 when BWP switch occurs on a single CC.

When UL BWP switch is triggered by consistent uplink LBT failures [7], UE is allowed to cause interruption of up to X slot to other active serving cells due to switching its active UL BWP involving changes in any of the parameters listed in Table 8.2.2.2.5-2 if the UE is not capable of per-FR gap, or if the BWP switching involves SCS changing. When the UL BWP switch imposes changes in any of the parameters listed in Table 8.2.2.2.5-2 and the UE is capable of per-FR gap, the UE is allowed to cause interruption of up to X slot to other active serving cells in the same frequency range wherein the UE is performing UL BWP switching. X is defined in Table 8.2.2.2.5-1. The starting time of interruption is only allowed within the UL BWP switching delay $T_{BWPswitchDelay}$ as defined in clause 8.6.2. Interruptions are not allowed during BWP switch involving other parameter change.

Table 8.2.2.2.5-1: Interruption length X

μ	NR Slot length (ms)	Interruption length X (slots)
0	1	1
1	0.5	1
2	0.25	3
3	0.125	5
Note1:	void	

Table 8.2.2.2.5-2: Parameters which cause interruption other than SCS

Parameters	Comment
locationAndBandwidth	From TS 38.331 [2]
nrofSRS-Ports	
maxMIMO-Layers-r16	

8.2.2.2.6 Interruptions at inter-frequency SFTD measurement

The requirements in this clause concern interruptions on PCell, as well as on activated SCells in MCG, when the UE is performing SFTD measurements on inter-frequency neighbour cell(s). The following requirements apply when no PSCell is configured.

For a UE with per-FR gap capability:

- for neighbour cell in FR1:
  - the percentage of interrupted slots on uplink and downlink on FR1 serving cells during the SFTD measurement period $T_{measure\_SFTD1}$ specified in Clause 9.3.8 shall not exceed the percentages specified in Table 8.2.2.2.6-1. No interruption is allowed on FR2 serving cells.
  - the length of each interruption on FR1 serving cells shall not exceed the number of slots specified in Table 8.2.2.2.6-2.
- for neighbour cell in FR2:
  - the percentage of interrupted slots on uplink and downlink on FR2 serving cells during the SFTD measurement period $T_{measure\_SFTD1}$ specified in Clause 9.3.8 shall not exceed the percentages specified in Table 8.2.2.2.6-1. No interruption is allowed on FR1 serving cells.
  - the length of each interruption on FR2 serving cells shall not exceed the number of slots specified in Table 8.2.2.2.6-2.

For a UE with per-UE gap capability:

- for neighbour cell in FR1 or FR2:
  - the percentage of interrupted slots on uplink and downlink on FR1 and FR2 serving cells during the SFTD measurement period $T_{measure\_SFTD1}$ specified in Clause 9.3.8 shall not exceed the percentages specified in Table 8.2.2.2.6-1.
  - the length of each interruption on FR1 and FR2 serving cells shall not exceed the number of slots specified in Table 8.2.2.2.6-2.

Table 8.2.2.2.6-1: Requirements on maximum percentage of interrupted slots in serving cell in inter-frequency SFTD

SFTD configuration	Serving cell μ	Neighbour cell SMTC periodicity					
		5ms	10ms	20ms	40ms	80ms	160ms
With RSRP report	0	8.4%	6.3%	8.4%	6.3%	5.3%	4.7%
	1						
	2						
	3						
Without RSRP report	0	11.4%	8.6%	7.9%	6.8%	6.3%	6.0%
	1						
	2						
	3						

Table 8.2.2.2.6-2: Interruption duration for FR1 serving cell in inter-frequency SFTD with neighbour cell in FR1

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1
1	0.5	2
2	0.25	4
3	0.125	8

Table 8.2.2.2.6-3: Void

Table 8.2.2.2.6-4: Void

8.2.2.2.7 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with PCell and up to 7 downlink SCell(s).

When multiple SCell is activated or deactivated by one single MAC CE command:

- an interruption on any active serving cell is specified as in clause 8.2.2.2.2:

8.2.2.2.8 Interruptions due to UE-specific CBW change

The requirements in clause 8.2.1.2.11 apply for this clause.

8.2.2.2.9 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to another activated carrier;
- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;
- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS38.331 [2];
- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26].
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101 [5], the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR1 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.2.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR2 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.2.2.9-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR1 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.2.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR2 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.2.2.9-2.

Table 8.2.2.2.9-1: Interruption length X1 (slot)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us)Note 1	Interruption length X1 (slots) Sub carrier spacing for agressor cell (kHz)	
			15	30
0	1	≤ 200	2	2
		300, 500	2	2
		900	2	2
1	0.5	≤ 200	3	2
		300, 500	3	3
		900	4	4
2	0.25	≤ 200	4	3
		300, 500	5	4
		900	7	6
3	0.125	≤ 200	7	5
		300, 500	9	7
		900	12	10
Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

Table 8.2.2.2.9-2: Interruption length X2 (slot)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us) Note 1	Interruption length X2 (slots) Sub carrier spacing for agressor cell (kHz)	
			60	120
0	1	≤ 200	2	2
1	0.5	≤ 200	2	2
2	0.25	≤ 200	3	3
3	0.125	≤ 200	4	4

For intra-band SRS carrier switching in FR1 or FR2, interruptions in Table 8.2.2.2.9-1 and in Table 8.2.2.2.9-2 based on SRS carrier switching time ≤ 200us shall apply. For inter-band SRS carrier switching in FR1 or between FR1 and FR2, interruptions in Table 8.2.2.2.9-1 and in Table 8.2.2.2.9-2 shall apply.

8.2.2.2.10 DL Interruptions at UE switching between two uplink carriers

The DL interruption requirements at dynamic switching between two uplink carreirs specified in this clause are applicable for an uplink band pair of an inter-band UL CA configuration when the capability *uplinkTxSwitchingPeriod* is present, and is only applicable for uplink switching mechanism specified in clause 6.1.6 of TS 38.214 [26], where NR uplink carrier 1 is capable of one transmit antenna connector and NR uplink carrier 2 is capable of two transmit antenna connectors, and the two uplink carriers are in different bands with different carrier frequencies.

When dynamic switching between two uplink carriers is conducted, UE is allowed to cause DL interruption of X OFDM symbols in NR downlink carrier(s) as indicated by *uplinkTxSwitching-DL-Interruption* [2]. The DL interruption starts from the first OFDM symbol which fully or partially overlaps with the UL switching period located in either NR carrier 1 or carrier 2 as indicated in RRC signalling [2]. The DL interruption lengths of X are defined in Table 8.2.2.2.10-1.

No DL interruption is allowed in the NR downlink carrier(s) which is not indicated by *uplinkTxSwitching-DL-Interruption*. No DL interruption is allowed for some inter-band UL CA configurations as specified in clause 5.2A.2 of TS 38.101-1 [18].

Table 8.2.2.2.10-1: DL interruption length on NR carrier(s) in the unit of OFDM symbols (X) for switching between two uplink carriers

μ	NR Slot length (ms)	Uplink Tx switching period [Note1]		
		35us	140us	210us
0	1	2	3	4
1	0.5	3	6	7
2	0.25	4	10	14
Note 1: Uplink Tx switching period depends on UE capability *uplinkTxSwitchingPeriod*				

8.2.2.2.11 Interruptions at direct SCell activation

When one or multiple SCell(s) are directly activated at SCell addition,

- the UE is allowed an interruption on any active serving cell:
  - of up to the duration shown in Table 8.2.2.2.1-1, if the active serving cell is not in the same band as the SCell being directly activated, or
  - of up to the duration shown in Table 8.2.2.2.1-2, if the active serving cells are in the same band as the SCell being activated provided the cell specific reference signals from the active serving cells and the SCell being activated are available in the same slot.

8.2.2.2.12 Interruptions due to SCell dormancy

8.2.2.2.12.1 Interruptions due to SCell dormancy switch

When one SCell in MCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in MCG as defined in clause 8.2.2.2.5, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP
- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in MCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.2.2.12.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5%.

8.2.2.2.12.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed [1.0]%.

8.2.2.2.13 Interruptions at transitions between active and non-active during DRX

For the UEs that are capable of *secondaryDRX-Group*[14] in FR1+FR2 CA, when two DRX groups are configured each group of serving cells, no interruption is allowed for UEs supporting either per UE or per FR gaps.

8.2.2.2.14 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in Table 8.2.2.2.14-1 for each interruption during MIB decoding time period T_{MIB} specified in clause 9.11.
- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in Table 8.2.2.2.14-1 during SIB1 decoding time period T_{SIB1} specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.
- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in Table 8.2.2.2.14-1 during SIB1 decoding time period T_{SIB1} specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and
- L1 = 6 x N, where N =1 if $T_{SMTC} \leq$ 20ms, or N = T_{SMTC} / 20ms if T_{SMTC} > 20ms. T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier, and
- L2 = 6.

Table 8.2.2.2.14-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10
2	0.25	24	25	19
3	0.125	48	49	37

8.2.2.2.15 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period $T_{identify\_CGI,\ E\text{-}UTRA}$ specified in clause 9.4.7.1, the UE shall be able to transmit at least the number of ACK/NACKs specified in Table 8.2.2.2.15-1 on PCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured.

Table 8.2.2.2.15-1: Minimum number of ACK/NACKs transmitted by the UE during $T_{identify\_CGI,\ E\text{-}UTRA}$

Minimum number of transmitted ACK/NACKs	SCS	
	Duplex mode configuration	SCS
	Duplex mode configuration	SCS

84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

8.2.3 NE-DC Interruptions

8.2.3.1 Introduction

This clause contains the requirements related to the interruptions on PCell and SCell, when

E-UTRA PSCell transitions between active and non-active during DRX, or

E-UTRA PSCell transitions from non-DRX to DRX, or

E-UTRA PSCell/SCell in SCG or SCell in MCG is added or released, or

E-UTRA PSCell/SCell in SCG or SCell(s) in MCG is activated or deactivated, or

measurements on SCC with deactivated SCell in either E-UTRA SCG or NR MCG or

PUSCH/PUCCH carrier configuration and deconfiguration in NR MCG, or

UL/DL BWP is switched on PCell or SCell in MCG, or

CGI reading of an NR neighbour cell with autonomous gaps, or

CGI reading of an E-UTRA neighbour cell with autonomous gaps.

NR SRS carrier based switching, or

E-UTRA SRS carrier based switching.

The requirements shall apply for NE-DC with an NR PCell.

This clause contains interruptions where victim cell is PCell or SCell belonging to MCG. Requirements for interruptions requirements when the victim cell is E-UTRA PSCell or E-UTRA SCell belonging to SCG are specified in TS 36.133 [15].

For a UE which does not support per-FR measurement gap, interruptions to the PCell, E-UTRA PSCell or activated MCG SCells may be caused by EUTRA PSCell, EUTRA SCells or SCells on any frequency range. For UE which support per-FR gap, interruptions to the PCell, E-UTRA PSCell or activated MCG SCells may be caused by EUTRA PSCell, EUTRA SCells or SCells on the same frequency range as the victim cell.

8.2.3.2 Requirements

8.2.3.2.1 Interruptions at transitions between active and non-active during DRX

Interruption on PCell and the activated SCell if configured due to E-UTRA PSCell transitions between active and non-active druing DRX when PCell or SCell is in non-DRX are allowed with up to 1% probability of missed ACK/NACK when the configured E-UTRA PSCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured E-UTRA PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slot as defined in table 8.2.3.2.1-1.

Table 8.2.3.2.1-1: Interruption length X at transition between active and non-active during DRX

μ	NR slot length (ms)	Interruption length X (slots)	
		Sync	Async
0	1	1	2
1	0.5	1	2
2	0.25	3	
3	0.125	5	

When both PCell and E-UTRA PSCell are in DRX, no interruption is allowed.

8.2.3.2.2 Interruptions at transitions from non-DRX to DRX

Interruption on PCell and the activated SCell if configured due to E-UTRA PSCell transitions from non-DRX to DRX when PCell or SCell is in non-DRX shall not exceed X slots as defined in table 8.2.3.2.1-1.

8.2.3.2.3 Interruptions at PSCell/SCell addition/release

The requirements in this clause shall apply for the UE configured with E-UTRA PSCell.

When one E-UTRA PSCell/SCell in SCG is added or released:

- the UE is allowed an interruption on any active serving cell in MCG:
  - of up to X1 slots, if the active serving cell is not in the same band as any of the E-UTRA PSCell/SCells being added or released, or
  - of up to max{Y1 slots + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA PSCell/SCells being added or released, provided the cell specific reference signals from the active serving cells and the E-UTRA PSCell/SCells being added or released are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above activated serving cells in MCG;

    Where X1 and Y1 are specified in Table 8.2.3.2.3-1.

When one SCell in MCG is added or released:

- the UE is allowed an interruption on any activated serving cell in MCG:
  - of up to X1 slots, if the active serving cell and the SCell being added or released are in a FR1 band pair or in a FR1+FR2 band pair.
  - of up to X1 slot, if the active serving cell and the SCell being added or released are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

  or

  - of up to Y1 slots + $T_{SMTC\_duration}$ if the active serving cells are in the same band as any of the SCells being added or released, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot, where, $T_{SMTC\_duration}$ is
    - the longest SMTC duration among all above active serving cells in MCG and the SCell being added when one SCell is added;
    - the longest SMTC duration among all above active serving cells in MCG when one SCell is released.

  Where X1 and Y1 are specified in Table 8.2.3.2.3-2.

Table 8.2.3.2.3-1: Interruption length X1 and Y1 at E-UTRA PSCell/SCell addition/release

μ	NR Slot length (ms)	Interruption length X1 (slots)		Interruption length Y1 (slots)	
		Sync	Async	Sync	Async

0	1	1	2	1	2
1	0.5	2	3	2	3
2	0.25	5		4	5
3	0.125	9		N/A	N/A

Table 8.2.3.2.3-2: Interruption length X1 and Y1 at SCell addition/Release

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)		Interruption length Y1 (slots)
0	1	1		1
1	0.5	2		2
2	0.25	Both aggressor cell and victim cell are on FR2	4	4
		Either aggressor cell or victim cell is on FR1	5	
3	0.125	Aggressor cell is on FR2	8	8
		Aggressor cell is on FR1	9	

8.2.3.2.4 Interruptions at SCell activation/deactivation

The requirements in this clause shall apply for the UE configured with E-UTRA PSCell and one SCell.

When one E-UTRA SCell in SCG is activated from deactivated or dormant state, or deactivated from activated or dormant state:

- the UE is allowed an interruption on any active serving cell in MCG:
  - of up to X2 slots, if the active serving cell and the SCell being activated or deactivated are in a FR1 band pair or in a FR1+FR2 band pair.
  - of up to X2 slot, if the active serving cells and the SCells being activated or deactivated are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair.

  or

  - of up to max{Y2 slots + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being activated or deactivated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being activated or deactivated are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above active serving cells in MCG.

    Where X2 and Y2 are specified in Table 8.2.3.2.4-1.

When one SCell in MCG is activated or deactivated:

- the UE is allowed an interruption on any serving cell in MCG:
  - of up to X2 slots, if the active serving cell is not in the same band as any of the SCells being activated or deactivated, or
  - of up to Y2 slots + $T_{SMTC\_duration}$ if the active serving cells are in the same band as any of the SCells being activated or deactivated, provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot, where, $T_{SMTC\_duration}$ is
    - the longest SMTC duration among all above active serving cells in MCGand the SCell being activated when one SCell is activated;
    - the longest SMTC duration among all above active serving cells in MCG when one SCell is deactivated.

    Where X2 and Y2 are specified in Table 8.2.3.2.4-2.

Table 8.2.3.2.4-1: Interruption length X2 and Y2 at E-UTRA SCell activation/deactivation

<table>
<tr><th rowspan="2">μ</th><th>NR Slot length (ms)</th><th colspan="2">Interruption length X2 (slots)</th><th colspan="2">Interruption length Y2 (slots)</th></tr>
<tr><th></th><th>Sync</th><th>Async</th><th>Sync</th><th>Async</th></tr>
<tr><td>0</td><td>1</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>1</td><td>0.5</td><td>1</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>2</td><td>0.25</td><td colspan="2">3</td><td>2</td><td>3</td></tr>
<tr><td>3</td><td>0.125</td><td colspan="2">5</td><td>N/A</td><td>N/A</td></tr>
</table>

Table 8.2.3.2.4-2: Interruption length X2 and Y2 at SCell activation/deactivation

<table>
<tr><th>μ</th><th>NR Slot length (ms) of victim cell</th><th colspan="2">Interruption length X2 (slots)</th><th>Interruption length Y2 (slots)</th></tr>
<tr><td>0</td><td>1</td><td colspan="2">1</td><td>1</td></tr>
<tr><td>1</td><td>0.5</td><td colspan="2">1</td><td>1</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">0.25</td><td>Both aggressor cell and victim cell are on FR2</td><td>2</td><td rowspan="2">2</td></tr>
<tr><td>Either aggressor cell or victim cell is on FR1</td><td>3</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">0.125</td><td>Aggressor cell is on FR2</td><td>4</td><td rowspan="2">4</td></tr>
<tr><td>Aggressor cell is on FR1</td><td>5</td></tr>
</table>

8.2.3.2.5 Interruptions during measurements on SCC

8.2.3.2.5.1 Interruptions during measurements on deactivated NR SCC

Interruption on PCell and other activated SCell(s) during measurement on the deactivated NR SCC shall meet requirements in clause 8.2.2.2.3.

8.2.3.2.5.2 Interruptions during measurements on deactivated E-UTRAN SCC

When one E-UTRA SCell in SCG is deactivated, the UE is allowed due to measurements on the E-UTRA SCC with the deactivated E-UTRA SCell:

- an interruption on PCell or any activated SCell with up to 0.5% probability of missed ACK/NACK when any of the configured *measCycleSCell* [15] for the deactivated E-UTRA SCells is 640 ms or longer.
- an interruption on PCell or any activated SCell with up to 0.5% probability of missed ACK/NACK regardless of the configured *measCycleSCell* [15] for the deactivated E-UTRA SCells if indicated by the network using IE *allowInterruptions* [15].

Each interruption shall not exceed

- X3 slots, if the PCell or activated SCell is not in the same band as the E-UTRA deactivated SCC being measured, or
- Y3 slots + SMTC duration, if the PCell or activated SCell is in the same band as the E-UTRA deactivated SCC being measured, provided the cell specific reference signals from the PCell or activated SCell and the E-UTRA deactivated SCC being measured are available in the same slot.

Where X3 and Y3 are specified in Table 8.2.3.2.5-1

Table 8.2.3.2.5-1: Interruption length X3 and Y3 at measurements on deactivated E-UTRA SCC

μ	NR Slot length (ms)	Interruption length X3 (slots)		Interruption length Y3 (slot)	
		Sync	Async	Sync	Async
0	1	1	2	1	2
1	0.5	1	2	1	2
2	0.25	3		2	3
3	0.125	5		N/A	N/A

8.2.3.2.5.3 Interruptions during CQI measurements on dormant E-UTRAN SCC

When one E-UTRA SCell in SCG is dormant, the UE is allowed due to CQI measurements on the dormant E-UTRA SCell:

- an interruption on PCell or any activated SCell with up to 0.5% probability of missed ACK/NACK.

Each interruption shall not exceed

- X3 slots, if the PCell or activated SCell is not in the same band as the E-UTRA dormant SCell being measured, or
- Y3 slots + SMTC duration, if the PCell or activated SCell is in the same band as the E-UTRA dormant SCell being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA dormant SCell being measured are available in the same slot.

Where X3 and Y3 are defined in Table 8.2.3.2.5.2-1.

8.2.3.2.5.4 Interruptions during RRM measurements on dormant E-UTRAN SCC

When one E-UTRA SCell in SCG is dormant, the UE is allowed due to RRM measurements on the E-UTRA SCC with the dormant E-UTRA SCell:

- an interruption on PCell or any activated SCell with up to 0.5% probability of missed ACK/NACK.

Each interruption shall not exceed

- X3 slots, if the PCell or activated SCell is not in the same band as the E-UTRA dormant SCC being measured, or
- Y3 slots + SMTC duration, if the PCell or activated SCell is in the same band as the E-UTRA dormant SCC being measured, provided the cell specific reference signals from the PSCell or activated SCell and the E-UTRA dormant SCC being measured are available in the same slot.

Where X3 and Y3 are defined in Table 8.2.3.2.5.2-1.

8.2.3.2.6 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NE-DC.

When an UL carrier or supplementary UL carrier is configured or deconfigured, an interruption of up to X4 slot as specified in Table 8.2.3.2.6-1, is allowed during the RRC reconfiguration procedure in TS 38.331 [2] on PCell, all activated SCells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of PCell, all activated E-UTRA SCells, E-UTRA PSCell and all activated SCells within the same FR as the configured or de-configured UL.

Table 8.2.3.2.6-1: Interruption length X4 at UL carrier RRC reconfiguration

μ	NR Slot length (ms)	Interruption length X4 (slots)	
		Sync	Async
0	1	1	2
1	0.5	2	3
2	0.25	5	
3	0.125	9	

8.2.3.2.7 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch , timer-based BWP switch or UL BWP switch triggered by consistent uplink LBT failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When UE receives a DCI indicating the UE to switch its active BWP, or when a BWP timer *bwp-InactivityTimer* defined in TS 38.331 [2] expires, or when the UE receives an RRC command indicating the UE to switch its active BWP or when UL BWP switch is triggered by consistent uplink LBT failures, the UE is allowed an interruption on PCell and any activated SCells as defined in clause 8.2.2.2.5.

8.2.3.2.8 Interruptions at direct SCell activation and hibernation

8.2.3.2.8.1 Interruptions during direct SCell activation and hibernation of E-UTRA SCell

When one E-UTRA SCell in SCG is directly activated and hibernated:

- the UE is allowed an interruption on any active serving cell in MCG:
  - of up to X1 slot, if the active serving cell is not in the same band as any of the E-UTRA SCells being directly activated or hibernated, or
  - of up to max{Y1 slot + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being directly activated or hibernated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being directly activated or hibernated are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above active serving cells in MCG.

  Where X1 and Y1 are specified in Table 8.2.3.2.3-1.

8.2.3.2.8.2 Interruptions during direct SCell activation

When one or multiple SCell(s) in MCG are directly activated at SCell addition:

- the UE is allowed an interruption on any active serving cell in MCG:
  - of up to X1 slot, if the active serving cell is not in the same band as the SCell being directly activated, or
  - of up to max{Y1 slot + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as the SCell being directly activated, provided the cell specific reference signals from the active serving cells and the SCell being directly activated are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above active serving cells in MCG.

  Where X1 and Y1 are specified in Table 8.2.3.2.3-2.

8.2.3.2.9 Interruptions at SCell hibernation

When one E-UTRA SCell in SCG is hibernated:

- the UE is allowed an interruption on any active serving cell in MCG:

- of up to X2 slot, if the active serving cell is not in the same band as any of the E-UTRA SCells being hibernated, or
- of up to max{Y2 slot + $T_{SMTC\_duration}$, 5ms} if the active serving cells are in the same band as any of the E-UTRA SCells being hibernated, provided the cell specific reference signals from the active serving cells and the E-UTRA SCells being hibernated are available in the same slot, where $T_{SMTC\_duration}$ is the longest SMTC duration among all above active serving cells in MCG.

Where X2 and Y2 are specified in Table 8.2.3.2.4-1.

8.2.3.2.10 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with E-UTRA PSCell and up to 6 downlink SCell(s).

When multiple SCells in MCG are activated or deactivated by one single MAC CE command:

- an interruption on any serving cell in MCG is specified as in clause 8.2.3.2.4.

8.2.3.2.11 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to another activated carrier;
- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;
- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS38.331 [2];
- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26].
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101 [5], the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of Per-FR gap, or on active serving cell(s) in MCG in FR1 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.3.2.11-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of Per-FR gap, or on active serving cell(s) in MCG in FR2 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.3.2.11-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of Per-FR gap, or on active serving cell(s) in MCG in FR1 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.3.2.11-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of Per-FR gap, or on active serving cell(s) in MCG in FR2 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.3.2.11-2.

Table 8.2.3.2.11-1: Interruption length X1 (slot)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us)Note 1	Interruption length X1 (slots) Sub carrier spacing for agressor cell (kHz)	
			15	30
0	1	≤ 200	2	2
		300, 500	2	2
		900	3	3
1	0.5	≤ 200	3	2
		300, 500	3	3
		900	4	4
2	0.25	≤ 200	4	3
		300, 500	5	4
		900	7	6
3	0.125	≤ 200	7	5
		300, 500	9	7
		900	12	10
Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

Table 8.2.3.2.11-2: Interruption length X2 (slot)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us) Note 1	Interruption length X2 (slots) Sub carrier spacing for agressor cell (kHz)	
			60	120
0	1	≤ 200	2	2
1	0.5	≤ 200	2	2
2	0.25	≤ 200	3	3
3	0.125	≤ 200	4	4

For intra-band SRS carrier switching in FR1 or FR2, interruptions in Table 8.2.3.2.11-1 and in Table 8.2.3.2.11-2 based on SRS carrier switching time ≤ 200us shall apply. For inter-band SRS carrier switching in FR1 or between FR1 and FR2, interruptions in Table 8.2.3.2.11-1 and in Table 8.2.3.2.11-2 shall apply.

8.2.3.2.12 Interruptions at E-UTRA SRS carrier based switching

A PUSCH-less carrier of SCell is a TDD carrier without PUCCH/PUSCH configured. When a UE needs to transmit periodic or aperiodic SRS [23] and/or non-contention based PRACH on a PUSCH-less carrier of SCell, the UE can perform carrier based switching to one or more PUSCH-less carrier of SCells from a carrier with PUSCH or from another PUSCH-less carrier of SCell prior to transmitting SRS and/or PRACH, provided that:

- switching is from a configured carrier to another activated TDD carrier;
- the PUSCH-less carrier of SCells to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission or configured via RRC [15] for periodic SRS transmission;
- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex [15];
- the SRS switching is not colliding with any other transmission with higher priority defined in TS36.213 [TBD];
- the SRS switching is not colliding with PDCCH in subframe 0 and 5 as specified in TS36.213 [TBD];
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 36.331 [2], and is compliant to the requirements for inter-band CA with uplink in one E-UTRA band and without simultaneous Rx/Tx specified in TS 36.101 [25], the SRS or RACH transmission are not simultaneously scheduled with DL subframe #0 or DL subframe #5 on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of Per-FR gap, or on active serving cell(s) in MCG in FR1 if UE is capable of Per-FR gap, during the switching to the PUSCH-less carrier of a serving cell,

- with up to X2 slot as specified in Table 8.2.3.2.12-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell in MCG if UE is not capable of Per-FR gap, or on active serving cell(s) in MCG in FR1 if UE is capable of Per-FR gap, during the switching from the PUSCH-less carrier of a serving cell,

- with up to X2 slot as specified in Table 8.2.3.2.12-1

Table 8.2.3.2.12-1: Interruption length X2 (slot)

μ	NR Slot length (ms)	Interruption length X2 (slots)
0	1	2
1	0.5	3
2	0.25	5
3	0.125	9

8.2.3.2.13 Interruptions due to SCell dormancy

8.2.3.2.13.1 Interruptions due to SCell dormancy switch

When one SCell in MCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in MCG as defined in clause 8.2.3.2.7, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP
- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in MCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.3.2.13.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5%.

8.2.3.2.13.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed [1.0]%.

8.2.3.2.14 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in Table 8.2.3.2.14-1 for each interruption during MIB decoding time period T_{MIB} specified in clause 9.11.

- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in Table 8.2.3.2.14-1 during SIB1 decoding time period T_{SIB1} specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.

- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in Table 8.2.3.2.14-1 during SIB1 decoding time period T_{SIB1} specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and

- L1 = 6 x N, where N =1 if $T_{SMTC} \leqslant$ 20ms, or N = T_{SMTC} / 20ms if T_{SMTC} > 20ms. T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier, and

- L2 = 6.

Table 8.2.3.2.14-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10
2	0.25	24	25	19
3	0.125	48	49	37

8.2.3.2.15 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period

- $T_{identify\_CGI, intra}$ specified in clause 8.1.2.2.3, or clause 8.1.2.2.4 in TS 36.133 [15], or

- $T_{identify\_CGI, inter}$ specified in clause 8.1.2.3.5, or clause 8.1.2.3.6, or clause 8.1.2.3.7, or clause 8.1.2.3.6 in TS 36.133 [15], or

- $T_{identify\_CGI, E-UTRA}$ specified in clause 9.4.7.1

the UE shall be able to transmit at least the number of ACK/NACKs specified in Table 8.2.3.2.15-1 on PCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,

- no DRX cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each slot,

- 2 slot ACK/NACK feedback is configured,

- 20 ms SMTC period is configured.

Table 8.2.3.2.15-1: Minimum number of ACK/NACKs transmitted by the UE

Minimum number of transmitted ACK/NACKs	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

8.2.4 NR-DC: Interruptions

8.2.4.1 Introduction

This clause contains the requirements related to the interruptions on PCell, PSCell and activated SCell if configured, when

up to 1 SCell in FR1 and up to 7 SCell(s) in FR2 are configured, deconfigured, activated or deactivated or,

a supplementary UL carrier or an UL carrier is configured or de-configured, or

measurements on SCC with deactivated SCell in NR SCG, or

UL/DL BWP is switched on PCell, PSCell or SCell.

transitions between active and non-active during DRX, or

transitions from non-DRX to DRX, or

CGI reading of an NR neighbour cell with autonomous gaps, or

CGI reading of an E-UTRA neighbour cell with autonomous gaps.

NR SRS carrier based switching.

Note: interruptions at SCell addition/release, activation/deactivation and during measurements on SCC may not be required by all UEs.

The interruptions shall not interrupt RRC signalling or ACK/NACKs related to RRC reconfiguration procedure [2] for SCell addition/release or MAC control signalling [17] for SCell activation/deactivation command.

The requirements shall apply for NR-DC with an NR PCell, PSCell or SCell.

For a UE which does not support per-FR measurement gap, interruptions to the PCell and activated SCell may be caused by SCells on any frequency range. For a UE which supports per-FR gaps, interruptions to PCell, PSCell and activated SCell may be caused by SCells on the same frequency range as the victim cell.

8.2.4.2 Requirements

8.2.4.2.1 Interruptions at PSCell/SCell addition/release

When PSCell or one or more SCells is added or released using the same *RRCConnectionReconfiguration* message as defined in TS 38.331 [2], the UE is allowed an interruption on any activated serving cell during the RRC reconfiguration procedure as follows:

- an interruption on any active serving cell:

- of up to the duration shown in table 8.2.4.2.1-1, if the active serving cell is not in the same band as any of the PSCell or SCells being added or released, where the requriements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as all of the PSCell and SCells being added or released, and the requriements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as any of the PSCell or SCells being added or released, or

- of up to the duration shown in table 8.2.4.2.1-2, if the active serving cells are in the same band as any of the SCells being added or released, provided the cell specific reference signals from the active serving cells and the SCells being added or released are available in the same slot.

Table 8.2.4.2.1-1: Interruption duration for PSCell/SCell addition/release for inter-band DC/CA

<table>
<tr><th rowspan="2">μ</th><th rowspan="2">NR Slot length (ms) of victim cell</th><th colspan="3">Interruption length (slots)</th></tr>
<tr><th colspan="2">Sync</th><th>Async</th></tr>
<tr><td>0</td><td>1</td><td colspan="2">1</td><td>2</td></tr>
<tr><td>1</td><td>0.5</td><td colspan="2">2</td><td>3</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">0.25</td><td>Both aggressor cell and victim cell are on FR2</td><td>4</td><td rowspan="2">5</td></tr>
<tr><td>Either aggressor cell or victim cell is on FR1</td><td>5</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">0.125</td><td>Aggressor cell is on FR2</td><td>8</td><td rowspan="2">9</td></tr>
<tr><td>Aggressor cell is on FR1</td><td>9</td></tr>
</table>

Table 8.2.4.2.1-2: Interruption duration for SCell addition/release for intra-band DC/CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
1	0.5	2 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
2	0.25	4 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
3	0.125	8 + $T_{SMTC\_duration}$ * $N_{slot}^{subframe,\mu}$
NOTE 1: $T_{SMTC\_duration}$ measured in subframes is - the longest SMTC duration among all above activeserving cells and the SCell being added when one SCell is added; - the longest SMTC duration among all active serving cells in the same band when one SCell is released. NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6]		

8.2.4.2.2 Interruptions at SCell activation/deactivation

When a SCell is activated or deactivated as defined in TS 37.340 [17], the UE is allowed

- an interruption on any active serving cell:

  - of up to the duration shown in table 8.2.4.2.2-1, if the active serving cell is not in the same band as any of the SCells being activated or deactivated, where the requriements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as all the SCells being activated, and the requriements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as any of the SCells being activated, or

- of up to the duration shown in table 8.2.4.2.2-2, if the active serving cells are in the same band as any of the SCells being activated or deactivated provided the cell specific reference signals from the active serving cells and the SCells being activated or deactivated are available in the same slot.

Table 8.2.4.2.2-1: Interruption duration for SCell activation/deactivation for inter-band DC/CA

μ	NR Slot length (ms) of victim cell	Interruption length (slots)		
		Sync		Async
0	1	1		2
1	0.5	1		2
2	0.25	Both aggressor cell and victim cell are on FR2	2	3
		Either aggressor cell or victim cell is on FR1	3	
3	0.125	Aggressor cell is on FR2	4	5
		Aggressor cell is on FR1	5	

Table 8.2.4.2.2-2: Interruption duration for SCell activation/deactivation for intra-band DC/CA

μ	NR Slot length (ms)	Interruption length (slots)
0	1	$1 + T_{SMTC\_duration} * N_{slot}^{subframe,\mu}$
1	0.5	$1 + T_{SMTC\_duration} * N_{slot}^{subframe,\mu}$
2	0.25	$2 + T_{SMTC\_duration} * N_{slot}^{subframe,\mu}$
3	0.125	$4 + T_{SMTC\_duration} * N_{slot}^{subframe,\mu}$
NOTE 1: $T_{SMTC\_duration}$ measured in subframes is - the longest SMTC duration among all above active serving cells and the SCell being activated when one SCell is activated; - the longest SMTC duration among all active serving cells in the same band when one SCell is deactivated. NOTE 2: $N_{slot}^{subframe,\mu}$ is as defined in TS 38.211 [6].		

8.2.4.2.3 Interruptions during measurements on SCC

Interruptions on PCell due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 8.2.2.2.2-1 if the PCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 8.2.2.2.2-2 if the PCell is in the same band as the deactivated SCell.

Interruptions on activated SCell due to measurements when an SCell is deactivated are allowed with up to 0.5% probability of missed ACK/NACK when the configured *measCycleSCell* [2] is 640 ms or longer. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption shall not exceed requirement in Table 8.2.2.2.2-1 if the activated SCell is not in the same band as the deactivated SCell. Each interruption shall not exceed requirement in Table 8.2.2.2.2-2 if the activated SCell is in the same band as the deactivated SCell.

8.2.4.2.4 Interruptions at UL carrier RRC reconfiguration

The requirements in this clause shall apply when a supplementary UL carrier or an UL carrier is configured or de-configured in NR-DC as defined in TS 38.331 [2].

When an UL carrier or supplementary UL carrier is configured or de-configured, an interruption of up to the duration shown in table 8.2.4.2.4-1, is allowed during the RRC reconfiguration procedure in TS38.331 [2] on all the other activated serving cells within the same FR as the reconfigured uplink carrier. The interruption is for both uplink and downlink of all the other serving cells within the same FR as the configured or de-configured UL.

Table 8.2.4.2.4-1: Interruption duration for UL carrier RRC reconfiguration

μ	NR Slot length (ms)	Interruption length (slots)
0	1	1
1	0.5	2
2	0.25	4
3	0.125	8

8.2.4.2.5 Interruptions due to Active BWP switching Requirement

The requirements for DCI-based BWP switch, timer-based BWP switch or UL BWP switch triggered by consistent uplink LBT failures in this clause apply to the case that the BWP switch is performed on a single CC or multiple CCs.

When either of the DCI-based, timer-based or RRC-based downlink BWP switch and/or uplink BWP switch occur on multiple CCs simultaneously or over partially overlapping period, the interruption requirements described in this clause apply for each BWP switch.

When UE receives a DCI indicating the UE to switch its active BWP, or when a BWP timer bwp-InactivityTimer defined in TS 38.331 [2] expires, or when the UE receives an RRC command indicating the UE to switch its active BWP or when UL BWP switch is triggered by consistent uplink LBT failures, the UE is allowed to cause an interruption on any other serving cells as defined in clause 8.2.2.2.5.

8.2.4.2.6 Interruptions at transitions between active and non-active during DRX

When PCell is in non-DRX and PSCell is in DRX, interruptions on PCell and the activated SCell in MCG if configured due to transitions from active to non-active and from non-active to active during PSCell DRX are allowed with up to 1% probability of missed ACK/NACK when the configured PSCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured PSCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slot as defined in table 8.2.4.2.6-1.

When PSCell is in non-DRX and PCell is in DRX, interruptions on PSCell on the activated SCell in SCG if configured due to transitions from active to non-active and from non-active to active during PCell DRX are allowed with up to 1 % probability of missed ACK/NACK when the configured PCell DRX cycle is less than 640 ms, and 0.625% probability of missed ACK/NACK is allowed when the configured PCell DRX cycle is 640 ms or longer. Each interruption shall not exceed X slot as defined in table 8.2.4.2.6-1.

Table 8.2.4.2.6-1: Interruption length X at transition between active and non-active during DRX

μ	NR Slot length (ms)	Interruption length X (slots)	
		Sync	Async
0	1	1	2
1	0.5	1	2
2	0.25	3	
3	0.125	5	

When both PCell and PSCell are in DRX, no interruption is allowed.

8.2.4.2.7 Interruptions at transitions from non-DRX to DRX

Interruption on PCell and the activated SCell in MCG if configured due to PSCell transitions from non-DRX to DRX when PCell is in non-DRX shall not exceed X slots as defined in table 8.2.4.2.6-1.

Interruption on PSCell and the activated SCell in SCG if configured due to PCell transitions from non-DRX to DRX when PSCell is in non-DRX shall not exceed X slots as defined in table 8.2.4.2.6-1.

8.2.4.2.8 Interruptions at SCell activation/deactivation with multiple downlink SCells

The requirements in this clause shall apply for the UE configured with NR-DC and up to 1 downlink SCell in FR1 and up to 7 downlink SCell(s) in FR2.

When multiple SCell are activated or deactivated by one single MAC CE command in MCG or SCG:

- an interruption on any serving cell in MCG or SCG is specified as in clause 8.2.4.2.2.

When multiple SCell are activated or deactivated in both MCG and SCG by two MAC CE commands respectively:

- an interruption on any serving cell in MCG is specified as in clause 8.2.4.2.2, and
- an interruption on any serving cell in SCG is specified as in clause 8.2.4.2.2.

8.2.4.2.9 Interruptions at NR SRS carrier based switching

SRS transmission can be configured on a carrier not configured for PUCCH/PUSCH transmission. When a UE needs to transmit periodic, semi-persistent or aperiodic SRS on a carrier of a serving cell not configured for PUCCH/PUSCH transmission, the UE can perform carrier based switching to one or more carriers not configured for PUCCH/PUSCH transmission from a carrier with PUCCH/PUSCH transmission or from a carrier not configured for PUCCH/PUSCH transmission prior to transmitting SRS, provided that:

- switching is from a configured carrier to another activated carrier;
- the carrier of SCells not configured for PUCCH/PUSCH transmission to which SRS carrier based switching is performed is indicated by DCI SRS request field for aperiodic SRS transmission, or indicated by MAC-CE for semi-persistent SRS transmission, or configured via RRC for periodic SRS transmission;
- the serving cell, from which SRS carrier based switching is performed and whose UL transmission may therefore be interrupted, is indicated by srs-SwitchFromServCellIndex and srs-SwitchFromCarrier in TS38.331 [2];
- the SRS switching is not colliding with any other transmission with higher priority defined in TS 38.214 [26].
- for UE, which does not support simultaneous reception and transmission for inter-band TDD CA specified in TS 38.331 [2], and is compliant to the requirements for inter-band CA with uplink in one NR band and without simultaneous Rx/Tx specified in TS 38.101 [5], the SRS transmission are not simultaneously scheduled with DL SSB/CSI-RS for L3 or L1 measurements transmission on other carriers.

The UE shall not perform SRS carrier based switching if the above conditions cannot be met.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR1 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.4.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR2 if UE is capable of Per-FR gap, during the switching to the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.4.2.9-2.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR1 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR1 not configured for PUCCH/PUSCH transmission,

- with up to X1 slot as specified in Table 8.2.4.2.9-1.

When SRS carrier based switching is performed between carriers, the UE is allowed interruptions on any active serving cell if UE is not capable of Per-FR gap, or on active serving cell(s) in FR2 if UE is capable of Per-FR gap, during the switching from the carrier of a serving cell in FR2 not configured for PUCCH/PUSCH transmission,

- with up to X2 slot as specified in Table 8.2.4.2.9-2.

Table 8.2.4.2.9-1: Interruption length X1 (slot)

μ	NR Slot length (ms) of victim cell	SRS carrier switching time (us)[Note 1]	Interruption length X1 (slots) Sub carrier spacing for agressor cell (kHz)	
			15	30
0	1	$\leq$ 200	2	2
		300, 500	2	2
		900	3	3
1	0.5	$\leq$ 200	3	2
		300, 500	3	3
		900	4	4
2	0.25	≤ 200	4	3
		300, 500	5	4
		900	7	6
3	0.125	≤ 200	7	5
		300, 500	9	7
		900	12	10
Note1: NR SRS carrier switching time is UE capability indicated by higher layer parameter *SRS-SwitchingTimeNR*.				

Table 8.2.4.2.9-2: Interruption length X2 (slot)

μ	NR Slot length (ms) of victim cell	SRS carrie switching time (us) [Note 1]	Interruption length X2 (slots) Sub carrier spacing for agressor cell (kHz)	
			60	120
0	1	$\leq$ 200	2	2
1	0.5	$\leq$ 200	2	2
2	0.25	$\leq$ 200	3	3
3	0.125	$\leq$ 200	4	4

For intra-band SRS carrier switching in FR1or FR2, interruptions in Table 8.2.2.2.9-1 and in Table 8.2.2.2.9-2 based on SRS carrier switching time ≤ 200us shall apply. For inter-band SRS carrier switching in FR1 or between FR1 and FR2, interruptions in Table 8.2.2.2.9-1 and in Table 8.2.2.2.9-2 shall apply.

8.2.4.2.10 Interruptions at direct SCell activation

When one or multiple SCell(s) are directly activated at SCell addition:

- the UE is allowed an interruption on any active serving cell:
  - of up to the duration shown in Table 8.2.4.2.1-1, if the active serving cell is not in the same band as the SCell being directly activated, where the requriements for Sync apply for synchronous NR-DC, and for asynchronous NR-DC if the active serving cell is in the same CG as the SCell being directly activated, and the requriements for Async apply for asynchronous NR-DC if the active serving cell is not in the same CG as the SCell being directly activated, or
  - of up to the duration shown in Table 8.2.4.2.1-2, if the active serving cells are in the same band as the SCell being directly activated provided the cell specific reference signals from the active serving cells and the SCell being directly activated are available in the same slot.

8.2.4.2.11 Interruptions when identifying CGI of an NR cell with autonomous gaps

When a UE is identifying CGI of an NR cell with autonomous gaps, the UE is allowed interruptions on PCell, PSCell or any activated SCell:

- with up to K1 interruptions with interrupted slots up to interruption length X1 specified in Table 8.2.4.2.11-1 for each interruption during MIB decoding time period T_{MIB} specified in clause 9.11.

- with up to L1 interruptions with interrupted slots up to interruption length Y1 specified in Table 8.2.4.2.11-1 during SIB1 decoding time period T_{SIB1} specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 1.

- with up to L2 interruptions with interrupted slots up to interruption length Y2 specified in Table 8.2.4.2.11-1 during SIB1 decoding time period T_{SIB1} specified in clause 9.11 for SSB and CORESET for RMSI scheduling multiplexing patterns 2 and 3.

Where:

- K1 = 6 for the target cell carrier frequency on FR1 and K1 = 25 for the target cell carrier frequency on FR2, and

- L1 = 6 x N, where N =1 if $T_{SMTC} \leqslant 20$ms, or N = T_{SMTC} / 20ms if $T_{SMTC} > 20$ms. T_{SMTC} is the periodicity of the SMTC occasion configured for the target cell carrier, and

- L2 = 6.

Table 8.2.4.2.11-1: Interruption length X1, Y1 and Y2 during measurements with autonomous gaps

μ	NR Slot length (ms) of victim cell	Interruption length X1 (slots)	Interruption length Y1 (slots)	Interruption length Y2 (slots)
0	1	6	7	6
1	0.5	12	13	10
2	0.25	24	25	19
3	0.125	48	49	37

8.2.4.2.12 Interruptions when identifying CGI of an E-UTRA cell with autonomous gaps

When a UE is identifying CGI of an E-UTRA FDD cell or E-UTRA TDD cell with autonomous gaps, within time period $T_{identify\_CGI,\ E\text{-}UTRA}$ specified in clause 9.4.7.1, the UE shall be able to transmit at least the number of ACK/NACKs specified in Table 8.2.4.2.12-1 on PCell, PSCell or any activated SCell in the frequency range where autonomous gaps are used, provided that:

- there is continuous DL data allocation,

- no DRX cycle is used,

- no measurement gaps are configured,

- only one code word is transmitted in each slot,

- 2 slot ACK/NACK feedback is configured,

- 20 ms SMTC period is configured.

Table 8.2.4.2.12-1: Minimum number of ACK/NACKs transmitted by the UE during $T_{identify\_CGI,\ E\text{-}UTRA}$

Minimum number of transmitted ACK/NACKs	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

8.2.4.2A Interruptions due to SCell dormancy

8.2.4.2A.1 Interruptions due to SCell dormancy switch

When one SCell in MCG or SCG is switched from dormancy to non-dormancy or from non-dormancy to dormancy [7] when UE is in DRX active time,

- the UE is allowed an interruption on active serving cell in MCG and SCG as defined in clause 8.2.4.2.5, except that the interruption is allowed regardless of which parameters change between the dormant BWP and the non-dormant BWP
- The starting time of interruption shall be within the dormancy switching delay as defined in clause 8.6.2.

When multiple SCells in MCG or SCG are switched from dormancy to non-dormancy or vice versa when the UE is in DRX active time, the interruption requirement described above applies for each BWP switch.

8.2.4.2A.2 Interruptions due to CQI measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of CQI measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from CQI measurements on dormant SCells shall not exceed 0.5%.

8.2.4.2A.3 Interruptions due to RRM measurements during SCell dormancy

When one or more SCells are in dormancy, the UE is for the purpose of RRM measurements on the dormant SCell(s) allowed to cause interruptions to non-dormant serving cell(s).

The rate of ACK/NACK feedback loss on any non-dormant serving cell resulting from RRM measurements on dormant SCells shall not exceed [1.0]%.

8.3 SCell Activation and Deactivation Delay

8.3.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to activate a deactivated SCell and deactivate an activated SCell in EN-DC, or in standalone NR carrier aggregation, or in NE-DC, or in NR-DC.

The requirements shall apply for EN-DC, standalone NR carrier aggregation, NE-DC, and NR-DC.

8.3.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this clause shall apply for the UE configured with one downlink SCell in EN-DC, or in standalone NR carrier aggregation or in NE-DC or in NR-DC and when one SCell is being activated.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot $n + \frac{T_{HARQ}+T_{activation\_time}+T_{CSI\_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation\_time}$ is the SCell activation delay in millisecond.

If the SCell is known and belongs to FR1, $T_{activation\_time}$ is:

- $T_{FirstSSB}$+ 5ms, if the SCell measurement cycle is equal to or smaller than 160ms.
- $T_{FirstSSB\_MAX}$ + T_{rs} + 5ms, if the SCell measurement cycle is larger than 160ms.

If the SCell is unknown and belongs to FR1, provided that the side condition Ês/Iot ⩾ -2dB is fulfilled, $T_{activation\_time}$ is:

- $T_{FirstSSB\_MAX} + T_{SMTC\_MAX} + 2*T_{rs}$ + 5ms.

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, then $T_{activation\_time}$ is $T_{FirstSSB}$+ 5ms provided:

- The UE is provided with SMTC for the target SCell, and
- The SSBs in the serving cell(s) and the SSBs in the SCell fulfil the condition defined in clause 3.6.3,
- The parameter *ssb-PositionsInBurst* is same for the serving cell(s) and the SCell.

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, if the UE is not provided with any SMTC for the target SCell, $T_{activation\_time}$ is 3 ms, provided

- the RS (s) of SCell being activated is (are) QCL-TypeD with RS (s) of one active serving cell on that FR2 band.

If the SCell being activated belongs to FR2 and if there is no active serving cell on that FR2 band provided that PCell or PSCell is in FR1 or in FR2:

If the target SCell is known to UE and semi-persistent CSI-RS is used for CSI reporting, then $T_{activation\_time}$ is:

- 3ms + max($T_{uncertainty\_MAC} + T_{FineTiming}$ + 2ms, $T_{uncertainty\_SP}$), where $T_{uncertainty\_MAC}$=0 and $T_{uncertainty\_SP}$=0 if UE receives the SCell activation command, semi-persistent CSI-RS activation command and TCI state activation command at the same time.

If the target SCell is known to UE and periodic CSI-RS is used for CSI reporting, then $T_{activation\_time}$ is:

- max($T_{uncertainty\_MAC}$ + 5ms + $T_{FineTiming}$, $T_{uncertainty\_RRC} + T_{RRC\_delay} - T_{HARQ}$), where $T_{uncertainty\_MAC}$=0 if UE receives the SCell activation command and TCI state activation commands at the same time.

If the PCell/PSCell and the target SCell are configured as FR1-FR2 CA or if the PCell/PSCell and the target SCell are in a FR2 band pair with independent beam management, and the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting, provided that the side condition Ês/Iot ≥ -2dB is fulfilled, then $T_{activation\_time}$ is:

- 6ms + $T_{FirstSSB\_MAX} + 15*T_{SMTC\_MAX} + 8*T_{rs} + T_{L1\text{-}RSRP,\ measure} + T_{L1\text{-}RSRP,\ report} + T_{HARQ}$ + max($T_{uncertainty\_MAC} + T_{FineTiming}$ + 2ms, $T_{uncertainty\_SP}$).

If the PCell/PSCell and the target SCell are configured as FR1-FR2 CA or if the PCell/PSCell and the target SCell are in a FR2 band pair with independent beam management, and the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting, provided that the side condition Ês/Iot ≥ -2dB is fulfilled, then $T_{activation\_time}$ is:

- 3ms + $T_{FirstSSB\_MAX} + 15*T_{SMTC\_MAX} + 8*T_{rs} + T_{L1\text{-}RSRP,\ measure} + T_{L1\text{-}RSRP,\ report}$ + max {($T_{HARQ} + T_{uncertainty\_MAC}$ + 5ms + $T_{FineTiming}$), ($T_{uncertainty\_RRC} + T_{RRC\_delay}$)}.

where,

T_{SMTC_MAX}:

- In FR1, in case of intra-band SCell activation, T_{SMTC_MAX} is the longer SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot; in case of inter-band SCell activation, T_{SMTC_MAX} is the SMTC periodicity of SCell being activated.
- In FR2, T_{SMTC_MAX} is the longer SMTC periodicity between active serving cells and SCell being activated provided that in Rel-15 only support FR2 intra-band CA.
- T_{SMTC_MAX} is bounded to a minimum value of 10ms.

T_{rs} is the SMTC periodicity of the SCell being activated if the UE has been provided with an SMTC configuration for the SCell in SCell addition message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement which involves T_{rs} is applied with T_{rs} = 5ms assuming the SSB transmission periodicity is 5ms. There are no requirements if the SSB transmission periodicity is not 5ms

$T_{FirstSSB}$: is the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$

$T_{FirstSSB\_MAX}$: Is the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, further fulfilling:

- In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.
- In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

$T_{FineTiming}$ is the time period between UE finish processing the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and the timing of first complete available SSB corresponding to the TCI state.

$T_{L1\text{-}RSRP,\ measure}$ is L1-RSRP measurement delay $T_{L1\text{-}RSRP\_Measurement\_Period\_SSB}$ ms or $T_{L1\text{-}RSRP\_Measurement\_Period\_CSI\text{-}RS}$ based on applicability as defined in clause 9.5 assuming M=1.

$T_{L1\text{-}RSRP,\ report}$ is delay of acquiring CSI reporting resources.

$T_{uncertainty\_MAC}$ is the time period between reception of the last activation command for PDCCH TCI, PDSCH TCI (when applicable) relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

$T_{uncertainty\_RRC}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

$T_{uncertainty\_SP}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting relative to

- SCell activation command for known case;
- First valid L1-RSRP reporting for unknown case.

T_{RRC_delay} is the RRC procedure delay as specified in TS38.331 [2].

Longer delays for RRM measurement requirements, and in case of FR2 also SSB based RLM/BFD/CBD/L1-RSRP measurement requirements, can be expected during the cell detection time for unknown SCell activation.

$T_{CSI\_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

SCell in FR1 is known if it has been meeting the following conditions:

- During the period equal to max(5*measCycleSCell, 5*DRX cycles) for FR1 before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and

  - the SSB measured remains detectable according to the cell identification conditions specified in clause 9.2 and 9.3.

- the SSB measured during the period equal to max(5*measCycleSCell, 5*DRX cycles) also remains detectable during the SCell activation delay according to the cell identification conditions specified in clause 9.2 and 9.3.

Otherwise SCell in FR1 is unknown.

The requirements for FR1 unknown SCell activation specified in this clause apply when one of the following conditions is met

- ‘ssb-PositionInBurst’ indicates only one SSB is being actually transmitted, or

- ‘ssb-PositionInBurst’ indicates multiple SSBs and TCI indication is provided in same MAC PDU with SCell activation.

For the first SCell activation in FR2 bands, the SCell is known if it has been meeting the following conditions:

- During the period equal to 4s for UE supporting power class1 and 3s for UE supporting power class 2/3/4 before UE receives the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and semi-persistent CSI-RS for CQI reporting (when applicable):

  - the UE has sent a valid L3-RSRP measurement report with SSB index

  - SCell activation command is received after L3-RSRP reporting and no later than the time when UE receives MAC-CE command for TCI activation

- During the period from L3-RSRP reporting to the valid CQI reporting, the reported SSBs with indexes remain detectable according to the cell identification conditions specified in clauses 9.2 and 9.3, and the TCI state is selected based on one of the latest reported SSB indexes.

Otherwise, the first SCell in FR2 band is unknown. The requirement for unknown SCell applies provided that the activation commands for PDCCH TCI, PDSCH TCI (when applicable), semi-persistent CSI-RS for CQI reporting (when applicable), and configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) are based on the latest valid L1-RSRP reporting.

If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the activation command, T_{SMTC_Scell} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. T_{SMTC_MAX} follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

The starting point of an interruption window on spCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot slot n+1+$\frac{T_{HARQ}+3ms+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation\_time}$ includes $T_{FirstSSB}$;

- $T_{FirstSSB\_MAX}$, for any scenario where $T_{activation\_time}$ includes $T_{FirstSSB\_MAX}$;

- $T_{uncertainty\_MAC}$ +$T_{FineTiming}$, for any scenario where $T_{activation\_time}$ includes $T_{FineTiming.}$

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this clause shall apply for the UE configured with one downlink SCell in EN-DC, or in standalone NR carrier aggregation, or in NE-DC, or in NR-DC.

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot $n + \frac{T_{HARQ}+3ms}{NR\ slot\ length}$. The starting point of an interruption window on spCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+$\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot n+1+$\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated.

Upon expiry of the *sCellDeactivationTimer* in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot $n + \frac{3ms}{NR\ slot\ length}$. The starting point of an interruption window on spCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1 and not occur after slot n+1+ $\frac{3ms}{NR\ slot\ length}$, where NR slot length is with respect to the numerology used in the SCell being deactivated.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

8.3.4 Direct SCell Activation at SCell addition

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], with one SCell for which the parameter *sCellState* is set to *activated*.

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. Upon receiving the RRC reconfiguration message in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot $\text{n} + \frac{N_{direct}}{NR\ slot\ length}$,

where:

$N_{direct} = T_{RRC\_Process} + T_1 + T_{activation\_time} + T_{CSI\_Reporting}$ - 3ms

$T_{RRC\_Process}$: RRC procedure delay defined in clause 12 of TS 38.331 [2],

T_1: Delay from slot $n + \frac{T_{RRC\_Process}}{NR\ slot\ length}$ until the transmission of RRCConnectionReconfigurationComplete message,

Note: T_1 is UE implementation dependent.

$T_{activation\_time}$ and $T_{CSI\_Reporting}$ are specified in clause 8.3.2, where the following definitions of $T_{FirstSSB}$ and $T_{FirstSSB\_MAX}$ shall override the existing ones:

- $T_{FirstSSB}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC\_Process}+T_1}{NR\ slot\ length}$
- $T_{FirstSSB\_MAX}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_{Process}}+T_1}{NR\ slot\ length}$
  - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.
  - In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The UE may be allowed to cause interruptions to serving cells on other component carriers during an interruption window, as specified in clause 8.2. The starting point of an interruption window on spCell or any activated SCell shall not occur before slot n+1, and shall not occur after slot $n+1+\frac{T_{RRC\_Process}+T_1+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation\_time}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB\_MAX}$, for any scenario where $T_{activation\_time}$ includes $T_{FirstSSB\_MAX}$;
- $T_{uncertainty\_MAC}$ $+T_{FineTiming}$, for any scenario where $T_{activation\_time}$ includes $T_{FineTiming}$.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

Starting from the slot $n+\frac{T_{RRC\_Process}+T_1}{NR\ slot\ length}$ until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

8.3.5 Direct SCell Activation at Handover

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], for handover with one SCell for which the parameter *sCellState* is set to *activated*.

The UE shall configure the SCell in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. Upon receiving the RRC reconfiguration message in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot $\mathrm{n}+\frac{N_{direct}}{NR\ slot\ length}$,

Where:

$N_{direct} = T_{RRC\_process} + T_{interrupt} + T_2 + T_3 + T_{activation\_time} + T_{CSI\_Reporting}$ - 3ms

$T_{RRC\_Process}$: RRC procedure delay defined in clause 12 of TS 38.331 [2],

$T_{interrupt}$: Interruption time during handover as specified in clause 6.1.1,

T_2: Delay from slot $n+\frac{T_{RRC\_Process}+T_{interrupt}}{NR\ slot\ length}$ until UE has obtained a valid TA command for the target PCell,

T_3: Delay for applying the received TA for uplink transmission in the target PCell, and greater than or equal to k+1 slot, where k is defined in clause 4.2 in TS 38.213,

$T_{activation\_time}$ and $T_{CSI\_Reporting}$ are specified in clause 8.3.2, where the following definitions of $T_{FirstSSB}$ and $T_{FirstSSB\_MAX}$ shall override the existing ones:

- $T_{FirstSSB}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC\_Process}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$
- $T_{FirstSSB\_MAX}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{RRC_{Process}}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$
  - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.
- In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The UE may be allowed to cause interruptions to PCell during an interruption window, as specified in clause 8.2. The starting point of an interruption window on PCell shall not occur before slot $n+1+\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$, and not occur after slot n+1+$\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation\_time}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB\_MAX}$, for any scenario where $T_{activation\_time}$ includes $T_{FirstSSB\_MAX}$;
- $T_{uncertainty\_MAC}$ +$T_{FineTiming}$, for any scenario where $T_{activation\_time}$ includes $T_{FineTiming}$.

The length of the interruption window depends on the frequency band relation between the aggressor SCell and the victim PCell.

Starting from the slot $n + \frac{T_{RRC\_Process} + T_{interrupt}+T_2+ T_3}{NR\ slot\ length}$ and until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCell.

8.3.6 Direct SCell Activation at RRCResume

The requirements in this clause apply for UE being configured in the RRC reconfiguration message in TS38.331 [2] for RRC Resume with one SCell for which the parameter *sCellState* is set to *activated*.

The requirements in clause 8.3.4 shall apply, except that the definition of T_1 shall be deemed to be replaced with

T_1: Delay from slot $n + \frac{T_{RRC\_Process}}{NR\ slot\ length}$ until the transmission of RRCResumeComplete message,

8.3.7 SCell Activation Delay Requirement for Deactivated SCell with Multiple Downlink SCells

The requirements in this clause shall apply for the UE configured with more than one SCells.

In EN-DC, NE-DC, standalone NR, or in one CG of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE only receives one single MAC command for multiple SCell activation within the activation period defined in this clause
- in each single CG, there are no other SCell activation, deactivation, addition or release before activation is completed for all the SCells activated by the single MAC CE in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before multiple SCell activation is completed in this clause, and
- any to-be-activated unknown SCell has active serving cell(s) or known to-be-activated SCell(s) on the same band

In two CGs of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE receives one MAC command per CG for multiple SCell activation within the activation period defined in this clause, and
- UE supports per-FR measurement gap capability, and
- any to-be-activated unknown SCell has active serving cell(s) or known to-be-activated SCell(s) on the same band

The delay within which the UE shall be able to activate the deactivated SCell with other downlink to-be-activated SCell(s) depends upon the specified conditions.

Upon receiving SCell activation command in slot *n* for more than one SCell, for each of the to-be-activated SCell, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot $\mathrm{n} + \frac{T_{HARQ}+T_{activation\_time\_multiple\_scells}+T_{CSI\_Reporting}}{NR\ slot\ length}$, where:

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]

$T_{activation\_time\_multiple\_scells}$ is the target SCell activation delay in millisecond in multiple SCell activation scenario.

If the SCell is known and belongs to FR1 and the SCell measurement cycle is equal to or smaller than 160ms, $T_{activation\_time\_multiple\_scells}$ is:

- $T_{FirstSSB\_MAX\_multiple\_scells} + T_{rs}$ + 5ms, if on the same band UE also has at least one parallel to-be-activated SCell which is FR1 known Scell with the SCell measurement cycle larger than 160ms but does not have any parallel to-be-activated SCell which is FR1 unknown SCell.
- $T_{FirstSSB\_MAX\_multiple\_scells} + T_{SMTC\_MAX\_multiple\_scells} + T_{rs}$ + 5ms, if on the same band UE also has at least one parallel to-be-activated SCell which is FR1 unknown Scell
- otherwise, $T_{FirstSSB\_MAX\_multiple\_scells}$ + 5ms.

If the SCell is known and belongs to FR1 and the SCell measurement cycle is larger than 160ms, $T_{activation\_time\_multiple\_scells}$ is:

- $T_{FirstSSB\_MAX\_multiple\_scells} + T_{SMTC\_MAX\_multiple\_scells} + T_{rs}$ + 5ms, if on the same band UE also has at least one parallel to-be-activated SCell which is FR1 unknown Scell
- otherwise, $T_{FirstSSB\_MAX\_multiple\_scells} + T_{rs}$ + 5ms

If the SCell is unknown and belongs to FR1, provided that the side condition Ês/Iot ⩾ -2dB is fulfilled, $T_{activation\_time\_multiple\_scells}$ is:

- $T_{FirstSSB\_MAX\_multiple\_scells} + T_{SMTC\_MAX\_multiple\_scells}+T_{rs}$ +5ms, if the SCell is not counted in N_1
- otherwise, $T_{FirstSSB\_MAX\_multiple\_scells} + T_{SMTC\_MAX\_multiple\_scells}+T_{rs}*N_1 +T_{rs}$ +5ms

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, then $T_{activation\_time\_multiple\_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.2.

If the SCell being activated belongs to FR2 and if there is at least one active serving cell on that FR2 band, if the UE is not provided with any SMTC for the target SCell, $T_{activation\_time\_multiple\_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.2

If the SCell being activated belongs to FR2 and if there is no active serving cell on that FR2 band provided that PCell or PSCell is FR1:

If the target SCell is known to UE and semi-persistent CSI-RS is used for CSI reporting, then $T_{activation\_time\_multiple\_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.2.

If the target SCell is known to UE and periodic CSI-RS is used for CSI reporting, then $T_{activation\_time\_multiple\_scells}$ is same as single SCell activation delay requirement as defined in clause 8.3.2.

If the target SCell is unknown to UE and semi-persistent CSI-RS is used for CSI reporting, provided that the side condition Ês/Iot ⩾ -2dB is fulfilled, then $T_{activation\_time\_multiple\_scells}$ is:

- 3 ms + max($T_{uncertainty\_MAC\_multiple\_scells} + T_{FineTiming}$ + 2ms, $T_{uncertainty\_SP\_multiple\_scells}$), if on the same band UE also has at least one parallel to-be-activated SCell which is FR2 known Scell. $T_{uncertainty\_MAC\_multiple\_scells}$ =0 and $T_{uncertainty\_SP\_multiple\_scells}$ =0 if UE receives the SCell activation command, semi-persistent CSI-RS activation command and TCI state activation commands at the same time.

If the target SCell is unknown to UE and periodic CSI-RS is used for CSI reporting, provided that the side condition Ês/Iot ⩾ -2dB is fulfilled, then $T_{activation\_time\_multiple\_scells}$ is:

- max($T_{uncertainty\_MAC\_multiple\_scells}$ + 5ms + $T_{FineTiming}$, $T_{uncertainty\_RRC\_multiple\_scells} + T_{RRC\_delay} - T_{HARQ}$), if on the same band UE also has at least one parallel to-be-activated SCell which is FR2 known Scell . $T_{uncertainty\_MAC\_multiple\_scells}$ =0 if UE receives the SCell activation command and TCI state activation commands at the same time.

Where,

N_1 is the number counting for parallel FR1 unknown to-be-activated SCell(s) only except the ones which fulfilled the following conditions:

- contiguous to an active serving cell in the same band, or to a known SCell in the same band being activated by the same MAC PDU, and

- A single SSB is used in the unknown SCell; or multiple SSBs are used in the unknown SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and
- its *ssb-PositionInBurst* is same as the one of contiguous FR1 known cell or contiguous FR1 active serving cell, and
- its RTD with contiguous FR1 known cell or contiguous FR1 active serving cell is smaller than or equal to [CP duration] with respect to the to-be-activated SCell's SSB numerology and its reception power difference with contiguous FR1 known cell or contiguous FR1 active serving cell is smaller than or equal to *X*dB, and
- its SMTC offset is same as the one of contiguous FR1 known cell or contiguous FR1 active serving cell

However, when the following conditions are fulfilled, no activation requirement will be applied for this unknown SCell:

- contiguous to an active serving cell in the same band, or to a known SCell in the same band being activated by the same MAC PDU, and
- A single SSB is used in the unknown SCell; or multiple SSBs are used in the unknown SCell and TCI state indication for PDCCH is provided by the same MAC PDU used for SCell activation; and
- its *ssb-PositionInBurst* is same as the one of FR1 known cell or FR1 active serving cell, and
- its RTD with contiguous FR1 known cell or contiguous FR1 active serving cell is larger than [CP duration] with respect to the to-be-activated SCell's SSB numerology or its reception power difference with contiguous FR1 known cell or contiguous FR1 active serving cell is larger than *X*dB, and
- its SMTC offset is same as the one of FR1 known cell or FR1 active serving cell

$T_{SMTC\_MAX\_multiple\_scells}$:

- In FR1, in case of intra-band SCell activation, $T_{SMTC\_MAX\_multiple\_scells}$ is the longest SMTC periodicity between active serving cells and SCells being activated on the same band provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot; in case of inter-band SCell activation, $T_{SMTC\_MAX\_multiple\_scells}$ is the longest SMTC periodicity of SCells being activated on the same band.
- In FR2, $T_{SMTC\_MAX\_multiple\_scells}$ is the longest SMTC periodicity between active serving cells and SCell(s) being activated in FR2 intra-band CA.
- $T_{SMTC\_MAX\_multiple\_scells}$ is bounded to a minimum value of 10ms.

$T_{FirstSSB\_MAX\_multiple\_scells}$: is the time to the end of the first complete SSB burst indicated by the SMTC after slot n + $\frac{T_{HARQ}+3ms}{NR\ slot\ length}$, further fulfilling:

- In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCells being activated are transmitting SSB burst.
- In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

$T_{uncertainty\_MAC\_multiple\_scells}$ is the time period between reception of the activation command for PDCCH TCI, PDSCH TCI (when applicable) and SCell activation command of this unknown SCell.

$T_{uncertainty\_SP\_multiple\_scells}$ is the time period between reception of the activation command for semi-persistent CSI-RS resource set for CQI reporting and SCell activation command of this unknown SCell.

$T_{uncertainty\_RRC\_multiple\_scells}$ is the time period between reception of the RRC configuration message for TCI of periodic CSI-RS for CQI reporting (when applicable) and SCell activation command of this unknown SCell.

T_{rs}, $T_{FineTiming}$, and T_{RRC_delay} is defined in clause 8.3.2.

Longer delays for RRM measurement requirements, and in case of FR2 also SSB based RLM/BFD/CBD/L1-RSRP measurement requirements, can be expected during the cell detection time for unknown SCell activation.

The condition of known SCell in FR1 or FR2 is defined in clause 8.3.2.

If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the activation command, T_{SMTC_Scell} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. $T_{SMTC\_MAX\_multiple\_scell}$ follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

The starting point and the end-point of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is same as single SCell activation requirement in clause 8.3.2.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

8.3.8 SCell Deactivation Delay Requirement for Activated SCell with Multiple Downlink SCells

The requirements in this clause shall apply for the UE configured with multiple downlink SCells in EN-DC, or in standalone NR carrier aggregation, or in NE-DC, or in NR-DC, provided that,

- in each single CG, there are no other SCell activation, deactivation, addition or release before deactivation is completed for all the SCells deactivated by the single MAC CE in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before multiple SCell deactivation is completed in this clause, and
- in EN-DC, NE-DC, NR-DC and standalone NR, UE only receives one single MAC command for multiple SCell deactivation within the deactivation period defined in this clause, or, in NR-DC, per-FR measurement gap capable UE receives one MAC command per CG for multiple SCell deactivation within the deactivation period defined in this clause

Upon receiving SCell deactivation command in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated within the same delay as specified in clause 8.3.3.

The starting point and the end-point of an interruption window on PCell or any activated SCell in MCG for NR standalone mode, or on PSCell or any activated SCell in SCG for EN-DC mode is same as single SCell activation requirement in clause 8.3.3.

8.3.9 Direct SCell Activation of Multiple Downlink SCells at SCell addition

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], with 2 SCells for which the parameter *sCellState* is set to *activated*.

In EN-DC, NE-DC, stand-alone NR, or in one CG of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE only receives one RRC reconfiguration message for direct activation of SCells within the activation period defined in this clause,
- in each single CG, there are no other SCell activation, deactivation, addition or release before direct activation is completed for all the SCells activated by the single RRC reconfiguration message in this clause, and
- in EN-DC and NE-DC, there are no E-UTRAN SCell activation, deactivation, addition or release before the direct SCell activation of multiple SCells in this clause is completed.

In two CGs of NR-DC, the requirements in this clause shall apply when the following conditions are met:

- UE receives one RRC message per CG for direct activation of SCells within the activation period defined in this clause,
- UE supports per-FR measurement gap capability, and
- any to-be-activated unknown SCell has active serving cell(s) or known to-be-activated SCell(s) on the same band.

The UE shall configure the SCells in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. Upon receiving the RRC reconfiguration message in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCell no later than in slot $\mathrm{n} + \frac{N_{direct\_multiple\_scells}}{NR\ slot\ length}$,

where:

$N_{direct\_multiple\_scells} = T_{RRC\_Process} + T_1 + T_{activation\_time\_multiple\_scells} + T_{CSI\_Reporting}$ - 3ms

T_1 and $T_{RRC\_Process}$ are specified in clause 8.3.4,

$T_{activation\_time\_multiple\_scells}$ and $T_{CSI\_Reporting}$ are specified in clause 8.3.7, where the following definition of $T_{FirstSSB}$, $T_{FirstSSB\_MAX}$, and $T_{FirstSSB\_MAX\_multiple\_scells}$ shall override the existing ones:

- $T_{FirstSSB}$ and $T_{FirstSSB\_MAX}$: as specified in clause 8.3.4,
- $T_{FirstSSB\_MAX\_multiple\_scells}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot $n + \frac{T_{RRC_{Process}}+T_1}{NR\ slot\ length}$, further fulfilling:
  - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCells being activated are transmitting SSB burst.
  - In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The UE may be allowed to cause interruptions to serving cells on other component carriers during an interruption window, as specified in clause 8.2. The starting point of an interruption window on spCell or any activated SCell shall not occur before slot $n+1+\frac{T_{HARQ}}{NR\ slot\ length}$, and shall not occur after slot $n+1+\frac{T_{RRC\_Process}+T_1+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation\_time\_multiple\_scells}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB\_MAX}$, for any scenario where $T_{activation\_time\_multiple\_scells}$ includes $T_{FirstSSB\_MAX}$;
- $T_{FirstSSB\_MAX\_multiple\_scell}$, for any scenario where $T_{activation\_time\_multiple\_scells}$ includes $T_{FirstSSB\_MAX\_multiple\_scells}$;
- $T_{uncertainty\_MAC} + T_{FineTiming}$, for any scenario where $T_{activation\_time\_multiple\_scells}$ includes $T_{FineTiming}$.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell.

Starting from the slot $n + \frac{T_{RRC\_Process} + T_1}{NR\ slot\ length}$ until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCells.

8.3.10 Direct SCell Activation of Multiple Downlink SCells at Handover

The requirements in this clause apply for UE being configured in the RRC reconfiguration message, TS 38.331 [2], for handover with 2 SCells for which the parameter *sCellState* is set to *activated*.

In MCG of NE-DC, MCG of NR-DC, or in stand-alone NR, the requirements in this clause shall apply when the following conditions are met:

- UE does not receive any RRC reconfiguration message for direct activation of SCells within the activation period defined in this clause,
- there is no other SCell activation, deactivation, addition or release before direct activation is completed for all the SCells activated by the single RRC reconfiguration message in this clause, and
- in NE-DC, there is no E-UTRAN SCell activation, deactivation, addition or release before the direct activation of SCells in this clause is completed.

The UE shall configure the SCells in activated state upon successful completion of the RRC reconfiguration procedure within the specified delay. Upon receiving the RRC reconfiguration message in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions for the directly activated SCells no later than in slot $n + \frac{N_{direct\_multiple\_scells}}{NR\ slot\ length}$, where:

$N_{direct\_multiple\_scells} = T_{RRC\_process} + T_{interrupt} + T_2 + T_3 + T_{activation\_time\_multiple\_scells} + T_{CSI\_Reporting}$ - 3ms

$T_{RRC\_Process}$, $T_{interrupt}$, T_2, and T_3 are specified in clause 8.3.5,

$T_{activation\_time\_multiple\_scells}$ and $T_{CSI\_Reporting}$ are specified in clause 8.3.7, where the following definitions of $T_{FirstSSB}$, $T_{FirstSSB\_MAX}$, and $T_{FirstSSB\_MAX\_multiple\_scells}$ shall override the existing ones:

- $T_{FirstSSB}$, $T_{FirstSSB\_MAX}$: as specified in clause 8.3.5,
- $T_{FirstSSB\_MAX\_multiple\_scell}$: the time to the end of the first complete SSB burst indicated by the SMTC after slot $n + \frac{T_{RRC\_Process}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$, further fulfilling:
  - In FR1, in case of intra-band SCell activation, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCells being activated are transmitting SSB burst.
  - In FR2, the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.321 [7] for an SCell at the first opportunities for the corresponding actions once the SCell is activated.

The UE may be allowed to cause interruptions to PCell during an interruption window, as specified in clause 8.2. The starting point of an interruption window on PCell shall not occur before slot $n+1+\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3}{NR\ slot\ length}$, and not occur after slot $n+1+\frac{T_{RRC\ Processing}+T_{interrupt}+T_2+T_3+T_X}{NR\ slot\ length}$, where NR slot length is with respect to the numerology of the SCell being activated, and T_X is:

- $T_{FirstSSB}$, for any scenario where $T_{activation\_time\_multiple\_scells}$ includes $T_{FirstSSB}$;
- $T_{FirstSSB\_MAX}$, for any scenario where $T_{activation\_time\_multiple\_scells}$ includes $T_{FirstSSB\_MAX}$;
- $T_{FirstSSB\_MAX\_multiple\_scell}$, for any scenario where $T_{activation\_time\_multiple\_scells}$ includes $T_{FirstSSB\_MAX\_multiple\_scells}$;
- $T_{uncertainty\_MAC} + T_{FineTiming}$, for any scenario where $T_{activation\_time\_multiple\_scells}$ includes $T_{FineTiming}$.

The length of the interruption window depends on the frequency band relation between the aggressor SCell and the victim PCell.

Starting from the slot $n + \frac{T_{RRC\_Process} + T_{interrupt}+T_2+ T_3}{NR\ slot\ length}$ and until the UE has completed the direct SCell activation, the UE shall report CQI index = 0 (out of range) if the UE has available uplink resources to report CQI for the SCells.

8.3.11 Direct SCell Activation of Multiple Downlink SCells at RRC Resume

The requirements in this clause apply for UE being configured in the RRC reconfiguration message in TS38.331 [2] for RRC Resume with 2 SCells for which the parameter *sCellState* is set to *activated*.

The requirements in clause 8.3.9 shall apply, except that the definition of T_1 shall be replaced by the corresponding definition in clause 8.3.6.

8.3A SCell Activation and Deactivation Delay in Carriers with CCA

8.3A.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to activate a deactivated SCell operating with CCA and deactivate an activated SCell operating with CCA in EN-DC or in standalone NR carrier aggregation.

In the requirements of clause 8.3A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period; otherwise the SMTC occasion is considered as available at the UE.

In the requirements of clause 8.3A, the term CSI-RS occasion not available at the UE due to DL CCA failures referes to when the CSI-RS is configured by gNB for the UE but not available at the UE due to DL CCA failures at gNB during the corresponding period.

The requirements shall apply for EN-DC and standalone NR carrier aggregation.

8.3A.2 SCell Activation Delay Requirement for Deactivated SCell

The requirements in this clause shall apply for the UE configured with one downlink SCell operating with CCA in EN-DC or in standalone NR carrier aggregation and when one SCell operating with CCA is being activated.

The delay within which the UE shall be able to activate the deactivated SCell depends upon the specified conditions.

Upon receiving SCell activation command in slot *n*, the UE shall be capable to transmit valid CSI report and apply actions related to the activation command for the SCell being activated no later than in slot n + (T_{HARQ} + $T_{activation\_time\_withCCA}$ + $T_{CSI\_reporting\_withCCA}$)/*NR_slot_length*, where:

- T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]. In the event of UE not being able to transmit the acknowledgment due to UL CCA failures: T_{HARQ} is extended to also include the time to all next HARQ feedback transmission and retransmission opportunities, until the time of its successful transmission, as specified in TS 38.213 [3]; no extension of T_{HARQ} due to UL LBT failures is allowed for Type 2C UL channel access procedure as defined in TS 37.213 [57].
  - $T_{activation\_time\_withCCA}$ is the SCell activation delay in millisecond.
    - If the SCell is known, $T_{activation\_time\_withCCA}$ is:
      - $T_{FirstSSB} + L_1 * T_{rs}$ + 5ms, if the SCell measurement cycle is equal to or smaller than 160ms.
      - $T_{FirstSSB\_MAX} + L_{2,1} * T_{SMTC\_MAX} + (1 + L_{2,2}) * T_{rs}$ + 5ms, if the SCell measurement cycle is larger than 160ms.
    - If the SCell is unknown, provided that the side condition Ês/Iot ⩾ -2 dB is fulfilled and the SCell can be successfully detected in one attempt, $T_{activation\_time\_withCCA}$ is:
      - $T_{FirstSSB\_MAX} + (1 + L_{3,1}) * T_{SMTC\_MAX} + (2 + L_{3,2}) * T_{rs}$ + 5ms.

    Where,

T_{SMTC_MAX}:

- In case of intra-band SCell activation, T_{SMTC_MAX} is the longest SMTC periodicity between active serving cells and SCell being activated provided the cell specific reference signals from the active serving cells and the SCells being activated or released are available in the same slot;

- In case of inter-band SCell activation, T_{SMTC_MAX} is the SMTC periodicity of SCell being activated;

- T_{SMTC_MAX} is bounded to a minimum value of 10ms.

T_{rs} is the SMTC periodicity of the SCell being activated if the UE has been provided with an SMTC configuration for the SCell in SCell addition message, otherwise T_{rs} is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement which involves T_{rs} is applied with T_{rs} = 5ms assuming the SSB transmission periodicity is 5ms. There are no requirements if the SSB transmission periodicity is not 5ms

$T_{FirstSSB}$: is the time to the end of the first complete configured SSB burst indicated by the SMTC after slot n + (T_{HARQ}+3ms)/*NR_slot_length*

$T_{FirstSSB\_MAX}$: is the time to the end of first complete configured SSB burst indicated by the SMTC after slot n + (T_{HARQ}+3ms)/*NR_slot_length* when all active serving cells and SCells being activated or released have configured SSB bursts in the same slot for intra-band scenario. In case of inter-band SCell activation, $T_{FirstSSB\_MAX}$ is the time to the end of the first complete configured SSB burst of the SCell being activated.

L_1 ($L_1 \le L_{1,max}$) is the number of configured SMTC occasions not available at the UE. $L_{1,max}$ = 2 if $T_{rs} \le 40$ ms; otherwise $L_{1,max}$ = 1.

$L_{2,1}$ ($L_{2,1} \le L_{2,1,max}$) and $L_{3,1}$ ($L_{3,1} \le L_{3,1,max}$) are the numbers of configured SMTC occasions not available at the UE, for a known and unknown SCell activation respectively,

in the SCell being activated, for inter-band scenario, or

in any of the SCells already activated or being activated provided their cell specific reference signals are configured in the same slot, for intra-band scenario

and $L_{2,1,max}$ = 2 if $T_{SMTC\_MAX} \le 40$ ms; otherwise $L_{2,1,max}$ = 1. $L_{3,1,max}$ = 2 if $T_{SMTC\_MAX} \le 40$ ms; otherwise $L_{3,1,max}$ = 1.

$L_{2,2}$ ($L_{2,2} \le L_{2,2,max}$) and $L_{3,2}$ ($L_{3,2} \le L_{3,2,max}$) are the number of configured SMTC occasions not available at the UE in the SCell being activated. $L_{2,2,max}$ = 2 if $T_{rs} \le 40$ ms; otherwise $L_{2,2,max}$ = 1. $L_{3,2,max}$ = 2 if $T_{rs} \le 40$ ms; otherwise $L_{3,2,max}$ = 1.

$T_{CSI\_reporting\_withCCA} = T_{CSI\_reporting} + L_4 * T_{CSI\text{-}RS} + T_{CSI\_ReportingDelay}$, where

$T_{CSI\_reporting}$ is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2].

$L_4 * T_{CSI\text{-}RS}$ is the additional delay in reception of CSI-RS due to the CSI-RS occasions unavailability at the UE due to DL CCA failures, where $T_{CSI\text{-}RS}$ is the periodicity of the configured CSI-RS, and L_4 ($L_4 \le L_{4,max}$) is the number of CSI-RS occasions not available at the UE due to DL CCA failures; $L_{4,max}$ = 2 if $T_{CSI\text{-}RS} \le 40$ms and $L_{4,max}$ = 1 otherwise.

$T_{CSI\_ReportingDelay}$ is the additional delay in transmission of CSI reporting due to UL CCA failures at the UE. If there are no uplink resources for reporting the valid CSI, then the UE shall use the next available opportunities for reporting the corresponding valid CSI as specified in TS 38.213 [3].

Upon exceeding any of the maximum numbers $L_{1,max}$, $L_{2,1,max}$, $L_{2,2,max}$, $L_{3,1,max}$, $L_{3,2,max}$, or $L_{4,max}$ of SMTC occasions or CSI-RS occasions, respectively, not available at the UE, the UE shall abandon the SCell activation procedure.

SCell operating with CCA is known if it has been meeting the following conditions:

- During the period equal to max(5 measCycleSCell, 5 DRX cycles) before the reception of the SCell activation command:
  - the UE has sent a valid measurement report for the SCell being activated and
  - the SSB measured remains detectable in the SMTC occasions available at the UE, according to the cell identification conditions specified in clause 9.2A and 9.3A.
- the SSB measured during the period equal to max(5 measCycleSCell, 5 DRX cycles) also remains detectable - the SSB measured during the period equal to max(5 measCycleSCell, 5 DRX cycles) also remains detectable in the SMTC occasions available at the UE during the SCell activation delay according to the cell identification conditions specified in clause 9.2A and 9.3A.

Otherwise SCell operating with CCA is unknown.

If the UE has been provided with higher layer in TS 38.331 [2] signaling of *smtc2* prior to the activation command, T_{SMTC_Scell} follows *smtc1* or *smtc2* according to the physical cell ID of the target cell being activated. T_{SMTC_MAX} follows *smtc1* or *smtc2* according to the physical cell IDs of the target cells being activated and the active serving cells.

In addition to CSI reporting defined above, UE shall also apply other actions related to the activation command specified in TS 38.331 [2] for a SCell at the first opportunities for the corresponding actions once the SCell is activated.

For intra-band CA, the starting point of an interruption window on SpCell or any activated SCell as specified in clause 8.2, shall not occur before slot n+1+ $\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot n+1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$, where T_X is:

- $T_{FirstSSB}$, for known SCell activation when SCell measurement cycle is equal to or smaller than 160ms;
- $T_{FirstSSB\_MAX} + L_{2,1}* T_{SMTC\_MAX}$ for known SCell activation when SCell measurement cycle is greater than 160ms;
- $T_{FirstSSB\_MAX} + L_{3,1}* T_{SMTC\_MAX}$ for unknown SCell activation

For inter-band CA, the starting point of an interruption window on SpCell or any activated SCell as specified in clause 8.2, shall not occur before slot n+1+ $\frac{T_{HARQ}}{NR\ slot\ length}$ and not occur after slot n+1+$\frac{T_{HARQ}+3+T_X}{NR\ slot\ length}$, where T_X is:

- $T_{FirstSSB}$, for known SCell activation when SCell measurement cycle is equal to, or smaller than, 160ms.

For intra-band CA, while the SCell being activated is known with measurement cycle equal to or smaller than 160ms, no more than one interruption window is allowed during SCell activation, and while the SCell being activated is unknown or known with measurement cycle greater than 160ms, up to 1+L interruption windows are allowed during SCell activation, where L = $L_{2,1}$ for known SCell and L = $L_{3,1}$ for unknown SCell. For a single interruption (L=0), interruption window length at SCell activation does not depend on DL CCA failures.

For inter-band CA, no more than one interruption window is allowed during the SCell activation.

Editor's Note: Whether to differentiate between the cases when there is or isn't an already active Scell in the same band as the Scell being activated is FFS.

The length of the interruption window may be different for different victim cells, and depends on the applicable scenario and on the frequency band relation between the aggressor cell and the victim cell. For a single interruption (L=0), the interruption window length at SCell activation does not depend on DL CCA failures.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed the SCell activation, the UE shall report out of range if the UE has available uplink resources to report CQI for the SCell.

Starting from the slot specified in clause 4.3 of TS 38.213 [3] (timing for secondary Cell activation/deactivation) and until the UE has completed a first L1-RSRP measurement, the UE shall report lowest valid L1 SS-RSRP range if the UE has available uplink resources to report L1-RSRP for the SCell.

Editor's Note: Applicability of SCell activation requirements for the case when sCellDeactivationTimer is not configured is FFS.

Editor's Note: UE behavior with respect to a configured sCellDeactivationTimer in SCell activation is FFS.

8.3A.3 SCell Deactivation Delay Requirement for Activated SCell

The requirements in this clause shall apply for the UE configured with one downlink SCell operating with CCA in EN-DC or in standalone NR carrier aggregation.

Upon receiving SCell deactivation command or upon expiry of the *sCellDeactivationTimer* in slot *n*, the UE shall accomplish the deactivation actions for the SCell being deactivated no later than in slot n+(T_{HARQ} +3ms)/*NR_slot_length*.

The interruption on SpCell or any activated SCell, as specified in clause 8.2, shall not occur before slot n+1+T_{HARQ}/*NR_slot_length* and not occur after slot n+1+(T_{HARQ} +3ms)/*NR_slot_length*.

Editor's Note: Applicability of SCell deactivation requirements for the case when sCellDeactivationTimer is not configured is FFS.

Editor's Note: UE behavior with respect to a configured sCellDeactivationTimer in SCell deactivation is FFS.

8.4 UE UL carrier RRC reconfiguration delay

8.4.1 Introduction

The requirements in this clause apply for a UE being configured or deconfigured with a supplementary UL carrier or NR UL carrier.

8.4.2 UE UL carrier configuration delay requirement

When the UE receives a RRC message implying NR UL or supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within $T_{UL\_carrier\_config}$ from the end of the last slot containing the RRC command.

$T_{UL\_carrier\_config}$ equals the maximum RRC procedure delay defined in clause 12 in TS 38.331 [2].

8.4.3 UE UL carrier deconfiguration delay requirement

When the UE receives a RRC message implying NR UL or supplementary UL carrier deconfiguration RRC signalling, the UE shall stop UL signalling on the deconfigured UL carrier within $T_{UL\_carrier\_deconfig}$ from the end of the last slot containing the RRC command.

$T_{UL\_carrier\_deconfig}$ equals the maximum RRC procedure delay defined in clause 12 in TS 38.331 [2].

8.5 Link Recovery Procedures

8.5.1 Introduction

The UE shall assess the downlink radio link quality of a serving cell based on the reference signal in the set $\overline{q}_0$ as specified in TS 38.213 [3] in order to detect beam failure on:

- PCell in SA, NR-DC, or NE-DC operation mode,
- PSCell in NR-DC and EN-DC operation mode,
- SCell in SA, NR-DC, NE-DC or EN-DC operation mode.

The RS resource configurations in the set $\overline{q}_0$ on PCell or PSCell can be periodic CSI-RS resources and/or SSBs. RS resource configuration in the set $\overline{q}_0$ on SCell shall be periodic CSI-RS. UE is not required to perform beam failure detection outside the active DL BWP. UE is not required to meet the requirements in clause 8.5.2 and 8.5.3 if UE does not have set $\overline{q}_0$. UE is not required to perform beam failure detection on a deactivated SCell, and also not required to perform beam failure detection on resources which is implicitly configured for a deactivated SCell. When more than 2 periodic CSI-RS resources on a CC are configured in the set $\overline{q}_0$ for current SCell or implicitly configured in the set $\overline{q}_0$ for other SCell, it is up to UE implementation to select two of CSI-RS resources in active BWP in current CC to perform beam failure detection. UE is not required to perform beam failure detection on a SCell on which $\overline{q}_1$ is not configured.

On each RS resource configuration in the set $\overline{q}_0$, the UE shall estimate the radio link quality and compare it to the threshold Q_{out_LR} for the purpose of accessing downlink radio link quality of the serving cell beams.

The threshold Q_{out_LR} is defined as the level at which the downlink radio level link of a given resource configuration on set $\overline{q}_0$ cannot be reliably received and shall correspond to the $BLER_{out}$ = 10% block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out\_LR\_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.5.2.1-1. For CSI-RS based beam failure detection, $Q_{out\_LR\_CSI-RS}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.5.3.1-1.

Upon request the UE shall deliver configuration indexes from the set $\overline{q}_1$ as specified in TS 38.213 [3] , to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold Q_{in_LR}, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained from an SSB. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained for a CSI-RS resource after scaling a respective CSI-RS reception power with a value provided by higher layer parameter *powerControlOffsetSS*. The RS resource configurations in the set $\overline{q}_1$ can be periodic CSI-RS resources or SSBs or both SSB and CSI-RS resources. UE is not required to perform candidate beam detection outside the active DL BWP. UE is not required to perform candidate beam detection on a SCell on which $\overline{q}_1$ is not configured.

8.5.2 Requirements for SSB based beam failure detection

8.5.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\overline{q}_0$ configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5.2.2. The requirements in this clause could not be applicable if UE is required to perform beam failure detection on more than 1 serving cell per band.

Table 8.5.2.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.5.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured SSB resource in set $\overline{q}_0$ estimated over the last $T_{Evaluate\_BFD\_SSB}$ ms period becomes worse than the threshold $Q_{out\_LR\_SSB}$ within $T_{Evaluate\_BFD\_SSB}$ ms period.

The value of $T_{Evaluate\_BFD\_SSB}$ is defined in Table 8.5.2.2-1 for FR1.

The value of $T_{Evaluate\_BFD\_SSB}$ is defined in Table 8.5.2.2-2 for FR2 with scaling factor N=8

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB.
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{SSB}}{Min(MGRP,T_{SMTCperiod})}}$, when the BFD-RS resource is partially overlapped with measurement gap (T_{SSB} <MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor}$ = 1, if the BFD-RS resource outside measurement gap is
  - not overlapped with the SSB symbols indicated by SSB-ToMeasure and 1 data symbol before each consecutive SSB symbols indicated by SSB-ToMeasure and 1 data symbol after each consecutive SSB symbols indicated by SSB-ToMeasure, given that SSB-ToMeasure is configured, and;
  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.
  - $P_{sharing\ factor}$ = 3, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, given the SMTC offset of all CCs in FR2 provided the same offset.

Longer evaluation period would be expected if the combination of BFD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify\_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 8.5.2.2-1: Evaluation period $T_{Evaluate\_BFD\_SSB}$ for FR1

Configuration	$T_{Evaluate\_BFD\_SSB}$ (ms)
no DRX	Max(50, Ceil(5 × P) × T_{SSB})
DRX cycle ≤ 320ms	Max(50, Ceil(7.5 × P) × Max(T_{DRX},T_{SSB}))
DRX cycle > 320ms	Ceil(5 × P) × T_{DRX}
Note: T_{SSB} is the periodicity of SSB in the set $\overline{q}_0$. T_{DRX} is the DRX cycle length.	

Table 8.5.2.2-2: Evaluation period $T_{Evaluate\_BFD\_SSB}$ for FR2

Configuration	$T_{Evaluate\_BFD\_SSB}$ (ms)
no DRX	Max(50, Ceil(5 × P × N) × T_{SSB})
DRX cycle ≤ 320ms	Max(50, Ceil(7.5 × P × N) × Max(T_{DRX},T_{SSB}))
DRX cycle > 320ms	Ceil(5 × P × N) × T_{DRX}
Note: T_{SSB} is the periodicity of SSB in the set $\overline{q}_0$. T_{DRX} is the DRX cycle length.	

8.5.2.3 Measurement restriction for SSB based beam failure detection

The UE is required to be capable of measuring SSB for BFD without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following scenarios.

For FR1, when the SSB for BFD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for BFD measurement without any restriction;
- If SSB and CSI-RS have different SCS,
    - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for BFD measurement without any restriction;
    - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

For FR2, when the SSB for BFD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

For FR2, there is no measurement restriction allowed when the network configures mixed numerology between SSB for BFD measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, provided that UE is capable of independent beam management on this FR2 band pair.

8.5.3 Requirements for CSI-RS based beam failure detection

8.5.3.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\overline{q}_0$ of resource configurations for a serving cell, provided that the CSI-RS resource(s) in set $\overline{q}_0$ for beam failure detection are actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5.3.2. UE is not expected to perform beam failure detection measurements on the CSI-RS configured for BFD if the CSI-RS is not QCL-ed, with QCL-TypeD when applicable, with the RS in the active TCI state of any CORESET configured in the UE active BWP. The requirements in this clause could not be applicable if UE is required to perform beam failure detection on more than 1 serving cell per band or on more than one band among a set of bands that it can receive with a common beam.

Table 8.5.3.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	0dB
Bandwidth (PRBs)	48
Sub-carrier spacing (kHz)	SCS of the active DL BWP
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.5.3.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the CSI-RS resource in set $\overline{q}_0$ estimated over the last $T_{Evaluate\_BFD\_CSI-RS}$ ms period becomes worse than the threshold $Q_{out\_LR\_CSI-RS}$ within $T_{Evaluate\_BFD\_CSI-RS}$ ms period.

The value of $T_{Evaluate\_BFD\_CSI-RS}$ is defined in Table 8.5.3.2-1 for FR1.

The value of $T_{Evaluate\_BFD\_CSI-RS}$ is defined in Table 8.5.3.2-2 for FR2 with N=1. The requirements of $T_{Evaluate\_BFD\_CSI-RS}$ apply provided that the CSI-RS for BFD is not in a resource set configured with repetition ON. The requirements shall not apply when the CSI-RS resource in the active TCI state of CORESET is the same CSI-RS resource for BFD and the TCI state information of the CSI-RS resource is not given, wherein the TCI state information means QCL Type-D to SSB for L1-RSRP or CSI-RS with repetition ON.

For FR1,

- $P = \frac{1}{1 - \frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS.
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when the BFD-RS resource is not overlapped with measurement gap and also not overlapped with SMTC occasion.
- $P = \frac{1}{1 - \frac{T_{CSI-RS}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- $P = P_{sharing\ factor}$, when the BFD-RS resource is not overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

    - $T_{SMTCperiod} \neq$ MGRP or

    - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(MGRP, T_{SMTCperiod})}}$, when the BFD-RS resource is partially overlapped with measurement gap ($T_{CSI-RS} <$ MGRP) and the BFD-RS resource is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when the BFD-RS resource is partially overlapped with measurement gap and the BFD-RS resource is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod} <$ MGRP)

- $P_{sharing\ factor} = 1$, if the BFD-RS resource outside measurement gap is

    - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and;

    - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- $P_{sharing\ factor} = 3$, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Note: The overlap between CSI-RS for BFD and SMTC means that CSI-RS for BFD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the BFD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer BFD evaluation period would be expected during the period $T_{identify\_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{BFD} used in Table 8.5.3.2-1 and Table 8.5.3.2-2 are defined as

- M_{BFD} = 10, if the CSI-RS resource(s) in set $\overline{q}_0$ used for BFD is transmitted with Density = 3 and over the bandwidth ⩾ 24 PRBs.

The values of P_{BFD} used in Table 8.5.3.2-1 and Table 8.5.3.2-2 are defined as

For each CSI-RS resource in the set $\overline{q}_0$ configured for PCell or PSCell

- P_{BFD} = 1,.

For each CSI-RS resource in the set $\overline{q}_0$ configured for a SCell

- P_{BFD} is the number of band(s) on which UE is performing beam failure detection only for SCell.

Table 8.5.3.2-1: Evaluation period $T_{Evaluate\_BFD\_CSI-RS}$ for FR1

Configuration	$T_{Evaluate\_BFD\_CSI-RS}$ (ms)
no DRX	Max(50, [$M_{BFD} \times P \times P_{BFD}$] × T_{CSI-RS})
DRX cycle ⩽ 320ms	Max(50, [1.5 × $M_{BFD} \times P \times P_{BFD}$] × Max($T_{DRX}$, T_{CSI-RS}))
DRX cycle > 320ms	[$M_{BFD} \times P \times P_{BFD}$] × T_{DRX}
Note: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\overline{q}_0$. T_{DRX} is the DRX cycle length.	

Table 8.5.3.2-2: Evaluation period $T_{Evaluate\_BFD\_CSI-RS}$ for FR2

Configuration	$T_{Evaluate\_BFD\_CSI-RS}$ (ms)
no DRX	Max(50, [$M_{BFD} \times P \times N \times P_{BFD}$] × T_{CSI-RS})
DRX cycle ⩽ 320ms	Max(50, [1.5 × $M_{BFD} \times P \times N \times P_{BFD}$] × Max($T_{DRX}$, T_{CSI-RS}))
DRX cycle > 320ms	[$M_{BFD} \times P \times N \times P_{BFD}$] × T_{DRX}
Note: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\overline{q}_0$. T_{DRX} is the DRX cycle length.	

8.5.3.3 Measurement restrictions for CSI-RS beam failure detection

The UE is required to be capable of measuring CSI-RS for BFD without measurement gaps. The UE is required to perform the CSI-RS measurements with measurement restrictions as described in the following scenarios.

For both FR1 and FR2, when the CSI-RS for BFD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for BFD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for BFD measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.

- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for BFD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for BFD measurement and SSB. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for BFD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for BFD measurement and the other CSI-RS. Longer measurement period for CSI-RS based BFD measurement is expected, and no requirements are defined.
  - The CSI-RS for BFD measurement or the other CSI-RS in a resource set configured with repetition ON, or
  - The other CSI-RS is configured in set $\overline{q}_1$ and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for BFD measurement without any restriction.

8.5.4 Minimum requirement for L1 indication

When the radio link quality on all the RS resources in set $\overline{q}_0$ is worse than Q_{out_LR}, layer 1 of the UE shall send a beam failure instance indication to the higher layers. A layer 3 filter may be applied to the beam failure instance indications as specified in TS 38.331 [2].

The beam failure instance evaluation for the RS resources in set $\overline{q}_0$ shall be performed as specified in clause 6 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication\_interval\_BFD}$.

When DRX is not used, $T_{Indication\_interval\_BFD}$ is max(2ms, $T_{SSB\text{-}RS,M}$)) or max(2ms, $T_{CSI\text{-}RS,M}$), where $T_{SSB\text{-}RS,M}$ and $T_{CSI\text{-}RS,M}$ is the shortest periodicity of all RS resources in set $\overline{q}_0$ for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set $\overline{q}_0$ or CSI-RS resource in the set $\overline{q}_0$.

When DRX is used, for SSB based link quality measurement,

- $T_{Indication\_interval\_BFD}$ = Max(1.5 × DRX_cycle_length, 1.5 × $T_{SSB\text{-}RS,M}$), if DRX_cycle_length $\leqslant$ 320ms,
- $T_{Indication\_interval\_BFD}$ = DRX_cycle_length, if DRX_cycle_length > 320ms.

When DRX is used, for CSI-RS based link quality measurement,

- $T_{Indication\_interval\_BFD}$ = Max(1.5 × DRX_cycle_length, 1.5 × $T_{CSI\text{-}RS,M}$), if DRX_cycle_length $\leqslant$ 320ms,
- $T_{Indication\_interval\_BFD}$ = DRX_cycle_length, if DRX_cycle_length > 320ms.

8.5.5 Requirements for SSB based candidate beam detection

8.5.5.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\overline{q}_1$ configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5.5.2. The requirements in this clause could not be applicable if UE is required to perform candidate beam detection on more than 1 serving cell per band or on more than one band among a set of bands that it can receive with a common beam.

8.5.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured SSB resource in set $\overline{q}_1$ estimated over the last $T_{Evaluate\_CBD\_SSB}$ ms period becomes better than the threshold Q_{in_LR} provided SSB_RP and SSB Ês/Iot are according to Annex Table B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5.5.2-1 and 8.5.5.2-2 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

The value of $T_{Evaluate\_CBD\_SSB}$ is defined in Table 8.5.5.2-1 for FR1.

The value of $T_{Evaluate\_CBD\_SSB}$ is defined in Table 8.5.5.2-2 for FR2 with scaling factor N=8.

where,

For FR1,

- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB,
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- $P = \frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- $P = \frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5 \times T_{SMTCperiod}$
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5 \times T_{SMTCperiod}$
- $P = \frac{1}{1-\frac{T_{SSB}}{Min(MGRP,T_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap
- $P = \frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor}$ = 1, if the candidate beam detection RS outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and;
  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured
- $P_{sharing\ factor}$ = 3, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{identify\_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of P_{CBD} used in Table 8.5.5.2-1 and Table 8.5.5.2-2 are defined as

For each SSB resource in the set $\overline{q}_1$ configured for PCell or PSCell

- P_{CBD} = 1.

For each SSB resource in the set $\overline{q}_1$ configured for a SCell

- P_{CBD} is the number of band(s) on which UE is performing candidate beam detection only for SCell.

Table 8.5.5.2-1: Evaluation period $T_{Evaluate\_CBD\_SSB}$ for FR1

Configuration	$T_{Evaluate\_CBD\_SSB}$ (ms)
non-DRX, DRX cycle ≤ 320ms	Max(25, Ceil(3 × P × P_{CBD}) × T_{SSB})
DRX cycle > 320ms	Ceil(3 × P × P_{CBD}) × T_{DRX}
Note: T_{SSB} is the periodicity of SSB in the set $\overline{q}_1$. T_{DRX} is the DRX cycle length.	

Table 8.5.5.2-2: Evaluation period $T_{Evaluate\_CBD\_SSB}$ for FR2

Configuration	$T_{Evaluate\_CBD\_SSB}$ (ms)
non-DRX, DRX cycle ≤ 320ms	Max(25, Ceil(3 × P × N × P_{CBD}) × T_{SSB})
DRX cycle > 320ms	Ceil(3 × P × N × P_{CBD}) × T_{DRX}
Note: T_{SSB} is the periodicity of SSB in the set $\overline{q}_1$. T_{DRX} is the DRX cycle length.	

8.5.5.3 Measurement restriction for SSB based candidate beam detection

For FR1, when the SSB for CBD measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for CBD measurement without any restrictions;
- If SSB and CSI-RS have different SCS-es,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for CBD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, when the SSB for CBD measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

For FR2, there is no measurement restriction allowed when the network configures mixed numerology between SSB for CBD measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, provided that UE is capable of independent beam management on this FR2 band pair.

8.5.6 Requirements for CSI-RS based candidate beam detection

8.5.6.1 Introduction

The requirements in this clause apply for each CSI-RS resource in the set $\overline{q}_1$ configured for a serving cell, provided that the CSI-RS resources configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5.6.2. The requirements in this clause could not be applicable if UE is required to perform candidate beam detection on more than 1 serving cell per band or on more than one band among a set of bands that it can receive with a common beam.

8.5.6.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CSI-RS resource in set $\overline{q}_1$ estimated over the last $T_{Evaluate\_CBD\_CSI-RS}$ [ms] period becomes better than the threshold Q_{in_LR} within $T_{Evaluate\_CBD\_CSI-RS}$ [ms] period provided CSI-RS Ês/Iot is according to Annex Table B.2.4.2 for a corresponding band.

The UE shall monitor the configured CSI-RS resources using the evaluation period in table 8.5.6.2-1 and 8.5.6.2-2 corresponding to the non-DRX mode, if the configured DRX cycle $\leqslant$ 320ms.

The value of $T_{Evaluate\_CBD\_CSI-RS}$ is defined in Table 8.5.6.2-1 for FR1.

The value of $T_{Evaluate\_CBD\_CSI-RS}$ is defined in Table 8.5.6.2-2 for FR2 with scaling factor N=8.

For FR1,

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P = 1, when candidate beam detection RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$ when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- P =$P_{sharing\ factor}$, when candidate beam detection RS is not overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$,, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5 \times T_{SMTCperiod}$

- $P = \frac{P_{\text{sharing factor}}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5 \times T_{SMTCperiod}$

- $P = \frac{1}{1-\frac{T_{CSI-RS}}{Min(MGRP,T_{SMTCperiod})}}$, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap

- $P = \frac{3}{1-\frac{T_{CSI-RS}}{MGRP}}$,, when candidate beam detection RS is partially overlapped with measurement gap and candidate beam detection RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

- $P_{\text{sharing factor}}$ = 1, if the candidate beam detection RS outside measurement gap is

  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and;

  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1 data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured.

- $P_{\text{sharing factor}}$ = 3, otherwise.

where,

If the high layer in TS 38.331 [2] signaling of *smtc2* is present, $T_{SMTCperiod}$ follows *smtc2*; Otherwise $T_{SMTCperiod}$ follows *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Note: The overlap between CSI-RS for CBD and SMTC means that CSI-RS for CBD is within the SMTC window duration.

Longer evaluation period would be expected if the combination of the CBD-RS resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Longer evaluation period would be expected if the CSI-RS is on the same OFDM symbols with RLM, BFD, BM-RS, or other CBD-RS, according to the measurement restrictions defined in clause 8.5.6.3.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer CBD evaluation period would be expected during the period $T_{identify\_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

The values of M_{CBD} used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

- M_{CBD} = 3, if the CSI-RS resource configured in the set $\overline{q}_1$ is transmitted with Density = 3 and over the bandwidth $\geqslant$ 24 PRBs.

The values of P_{CBD} used in Table 8.5.6.2-1 and Table 8.5.6.2-2 are defined as

For each CSI-RS resource in the set $\overline{q}_1$ configured for PCell or PSCell

- P_{CBD} = 1.

For each CSI-RS resource in the set $\overline{q}_1$ configured for a SCell

- P_{CBD} is the number of band(s) on which UE is performing candidate beam detection only for SCell.

Table 8.5.6.2-1: Evaluation period $T_{Evaluate\_CBD\_CSI-RS}$ for FR1

Configuration	$T_{EvaluateC\_CBD\_CSI-RS}$ (ms)
non-DRX, DRX cycle ≤ 320ms	Max(25, Ceil($M_{CBD} \times P \times P_{CBD}$) × T_{CSI-RS})
DRX cycle > 320ms	Ceil($M_{CBD} \times P \times P_{CBD}$) × T_{DRX}
Note: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\overline{q}_1$. T_{DRX} is the DRX cycle length.	

Table 8.5.6.2-2: Evaluation period $T_{Evaluate\_CBD\_CSI-RS}$ for FR2

Configuration	$T_{Evaluate\_CBD\_CSI-RS}$ (ms)
non-DRX, DRX cycle ≤ 320ms	Max(25, Ceil($M_{CBD} \times P \times N \times P_{CBD}$) × T_{CSI-RS})
DRX cycle > 320ms	Ceil($M_{CBD} \times P \times N \times P_{CBD}$) × T_{DRX}
Note: T_{CSI-RS} is the periodicity of CSI-RS resource in the set $\overline{q}_1$. T_{DRX} is the DRX cycle length.	

8.5.6.3 Measurement restriction for CSI-RS based candidate beam detection

For both FR1 and FR2, when the CSI-RS for CBD measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for CBD measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for CBD measurement, the UE shall be able to perform CSI-RS based CBD measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS based CBD measurement for without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer measurement period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for CBD measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for CBD measurement without any restriction.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and SSB. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for CBD measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both CSI-RS for CBD measurement and the other CSI-RS. Longer evaluation period for CSI-RS based CBD measurement is expected, and no requirements are defined.

8.5.7 Scheduling availability of UE during beam failure detection

Scheduling availability restrictions when the UE is performing beam failure detection are described in the following clauses.

8.5.7.1 Scheduling availability of UE performing beam failure detection with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to beam failure detection performed on SSB and CSI-RS configured for BFD with the same SCS as PDSCH or PDCCH in FR1.

8.5.7.2 Scheduling availability of UE performing beam failure detection with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to beam failure detection when SSB is configured as BFD. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to beam failure detection when SSB is configured as BFD.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for beam failure detection.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on FR1 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which PCell or PSCell is configured.

8.5.7.3 Scheduling availability of UE performing beam failure detection on FR2

The following scheduling restriction applies due to beam failure detection.

- For the case where no RSs are provided for BFD, or when CSI-RS is configured for BFD is explicitly configured and is type-D QCLed with active TCI state for PDCCH or PDSCH, and the CSI-RS is not in a CSI-RS resource set with repetition ON
    - There are no scheduling restrictions due to beam failure detection performed based on the CSI-RS.
- Otherwise
    - The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH or CSI-RS for tracking or CSI-RS for CQI on BFD-RS resource symbols to be measured for beam failure detection.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions on FR2 serving PCell or PSCell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to beam failure detection performed on FR2 serving cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE is expected to receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for BFD mesurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE is expected to receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for BFD mesurement.

8.5.7.4 Scheduling availability of UE performing beam failure detection on FR1 or FR2 in case of FR1-FR2 inter-band CA and NR DC

There are no scheduling restrictions on FR1 serving cell(s) due to beam failure detection performed on FR2 serving PCell and/or PSCell.

There are no scheduling restrictions on FR2 serving cell(s) due to beam failure detection performed on FR1 serving PCell and/or PSCell.

8.5.8 Scheduling availability of UE during candidate beam detection

Scheduling availability restrictions when the UE is performing L1-RSRP measurement for candidate beam detection are described in the following clauses.

8.5.8.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as link recovery detection resource with the same SCS as PDSCH or PDCCH in FR1.

8.5.8.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as link recovery detection resource. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured as link recovery detection resource.

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, TRS, CSI-RS for tracking or CSI-RS for CQI on SSB symbols to be measured for L1-RSRP.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on one serving cell apply to all other serving cells in the same band on the symbols that fully or partially overlap with the restricted symbols. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands.

8.5.8.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to candidate beam detection

- The UE is not expected to transmit PUCCH, PUSCH or SRS or receive PDCCH, PDSCH, CSI-RS for tracking or CSI-RS for CQI on reference symbols to be measured for candidate beam detection.

When intra-band carrier aggregation in FR2 is configured, the scheduling restrictions on to one serving cell apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to candidate beam detection performed on FR2 serving cell(s) in different band(s), provided that the FR2 serving cell(s) and the FR2 serving cell(s) for candidate beam detection are in a FR2 band pair and UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

For FR2, if following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE is expected to receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for CBD mesurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE is expected to receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for CBD mesurement.

8.5.8.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA and NR-DC

There are no scheduling restrictions on FR1 serving cell(s) due to L1-RSRP measurement performed on FR2 serving cell(s).

There are no scheduling restrictions on FR2 serving cell(s) due to L1-RSRP measurement performed on FR1 serving cell(s).

8.5.9 Requirements for Link Recovery with Link Recovery Request (LRR)

8.5.9.1 Introduction

For the UE provided with a configuration of PUCCH transmission with a link recovery request (LRR) as described in clause 9.2.4 in TS 38.213 [3], if beam failure is detected in any of SCells, the UE shall transmit MAC CE providing one index for at least one corresponding SCell with radio link quialty worse than $Q_{out,LR}$, and the index q_{new} for a periodic CSI-RS configuration or for a SSB provided by higher layer, as described in clause 5.17 of TS38.321 [7], if any, for a corresponding SCell.

8.5.9.2 Requirement

Provided that UE is configured by *schedulingRequestIDForBFR* a configuration for LRR in a PUCCH transmission, after BFR is triggered on any of SCells as described in clause 5.17 of TS38.321 [7], UE shall be capable of transmit PUCCH with a LRR within a period of T, where

- $T = T_1$ x $\mathrm{Ceil}((T_2+D) / T_1)$ in which T_1, T_2 and D are defined as
  - T_1 is equal to the periodicity of PUCCH configured with *schedulingRequestIDForBFR*.
  - $T_2 = T_{Evaluate\_CBD}$ is the evaluation period specified in clause 8.5.5 or 8.5.6 for SSB or CSI-RS based candidate beam detection, that is $T_{Evaluate\_CBD\_SSB}$ or $T_{Evaluate\_CBD\_CSI-RS}$, depending on the applicable reference signal configured for candidate beam detection.
  - D = 2ms is the UE Processing time.

8.5A Link Recovery Procedures when CCA is used on target frequency

8.5A.1 Introduction

The requirements for link recovery procedure in the clause apply when CCA is used on a serving frequency on the downlink.

The UE shall assess the downlink radio link quality of a serving cell based on the reference signal in the set $\bar{q}_0$ as specified in TS 38.213 [3] in order to detect beam failure on:

- PCell in SA operation mode,
- PSCell in EN-DC operation mode.

The RS resource configurations in the set $\bar{q}_0$ can be periodic SSBs. UE is not required to perform beam failure detection outside the active DL BWP. UE is not required to meet the requirements in clause 8.5A.2 and 8.5A.3 if UE does not have set $\bar{q}_0$.

On each RS resource configuration in the set $\bar{q}_0$, the UE shall estimate the radio link quality and compare it to the threshold Q_{out_LR} for the purpose of accessing downlink radio link quality of the serving cell beams.

The threshold Q_{out_LR} is defined as the level at which the downlink radio level link of a given resource configuration on set $\bar{q}_0$ cannot be reliably received and shall correspond to the $BLER_{out}$ = 10% block error rate of a hypothetical PDCCH transmission. For SSB based beam failure detection, $Q_{out\_LR\_SSB}$ is derived based on the hypothetical PDCCH transmission parameters listed in Table 8.5A.2.1-1.

Upon request the UE shall deliver configuration indexes from the set $\bar{q}_1$ as specified in TS 38.213 [3] , to higher layers, and the corresponding L1-RSRP measurement provided that the measured L1-RSRP is equal to or better than the threshold Q_{in_LR}, which is indicated by higher layer parameter *rsrp-ThresholdSSB*. The UE applies the Q_{in_LR} threshold to the L1-RSRP measurement obtained from an SSB. The RS resource configurations in the set $\bar{q}_1$ can be periodic SSBs. UE is not required to perform candidate beam detection outside the active DL BWP.

In the requirements of clause 8.5A, the term CBD-RS SSB occasions not available at the UE refers to when the CBD-RS SSB is configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the set of configured CBD-RS resources are not available at the UE due to DL CCA failures at gNB during the corresponding evaluation period; otherwise the CBD-RS SSB is considered as available at the UE.

8.5A.2 Requirements for SSB based beam failure detection

8.5A.2.1 Introduction

The requirements in this clause apply for each SSB resource in the set $\bar{q}_0$ configured for a serving cell, provided that the SSB configured for beam failure detection is actually transmitted within the UE active DL BWP during the entire evaluation period specified in clause 8.5A.2.2.

Table 8.5A.2.1-1: PDCCH transmission parameters for beam failure instance

Attribute	Value for BLER
DCI format	1-0
Number of control OFDM symbols	2
Aggregation level (CCE)	8
Ratio of hypothetical PDCCH RE energy to average SSS RE energy	0dB
Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	0dB
Bandwidth (PRBs)	24
Sub-carrier spacing (kHz)	Same as the SCS of RMSI CORESET
DMRS precoder granularity	REG bundle size
REG bundle size	6
CP length	Normal
Mapping from REG to CCE	Distributed

8.5A.2.2 Minimum requirement

UE shall be able to evaluate whether the downlink radio link quality on the configured BFD-RS SSB resource in set $\bar{q}_0$ estimated over the last $T_{Evaluate\_BFD\_SSB\_CCA}$ ms period becomes worse than the threshold $Q_{out\_LR\_SSB}$ within $T_{Evaluate\_BFD\_SSB\_CCA}$ ms period.

The value of $T_{Evaluate\_BFD\_SSB\_CCA}$ is defined in Table 8.5A.2.2-1, where

- $P = \frac{1}{1-\frac{T_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the BFD-RS SSB.

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the BFD-RS SSB.

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of BFD-RS SSB resource, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Table 8.5A.2.2-1: Evaluation period $T_{Evaluate\_BFD\_SSB\_CCA}$

Configuration	$T_{Evaluate\_BFD\_SSB\_CCA}$ (ms)	
	BFD-RS SSB Es/Iot [Note2] ≥ [-7] dB	BFD-RS SSB Es/Iot [Note2] < [-7] dB
no DRX	Max(50, Ceil(([10] × P) × T_{SSB}))	Max(50, Ceil(([12] × P) × T_{SSB}))
DRX cycle ≤ 320ms	Max(50, Ceil(1.5 × [8] × P) × Max(T_{DRX},T_{SSB}))	Max(50, Ceil(1.5 × [10] × P) × Max(T_{DRX},T_{SSB}))
DRX cycle > 320ms	Ceil([7] × P) × T_{DRX}	Ceil([8] × P) × T_{DRX}
Note 1: T_{SSB} is the periodicity of SSB in the set $\bar{q}_0$. T_{DRX} is the DRX cycle length. Note 2: BFD-RS SSB Es/Iot is the averaged BFD-RS SSB Es/Iot over the most recent previous evaluation period.		

8.5A.2.3 Measurement restriction for SSB based beam failure detection

The UE is required to be capable of measuring SSB for BFD without measurement gaps. The UE is required to perform the SSB measurements with measurement restrictions as described in the following clauses.

When the SSB for BFD measurement is in the same OFDM symbol as CSI-RS for BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for BFD measurement without any restriction;

- If SSB and CSI-RS have different SCS,

  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for BFD measurement without any restriction;

  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for BFD measurement and CSI-RS. Longer measurement period for SSB based BFD measurement is expected, and no requirements are defined.

8.5A.4 Minimum requirement for L1 indication

When the radio link quality on all the RS resources in set $\bar{q}_0$ is worse than Q_{out_LR}, layer 1 of the UE shall send a beam failure instance indication to the higher layers. A layer 3 filter may be applied to the beam failure instance indications as specified in TS 38.331 [2].

The beam failure instance evaluation for the RS resources in set $\bar{q}_0$ shall be performed as specified in clause 6 in TS 38.213 [3]. Two successive indications from layer 1 shall be separated by at least $T_{Indication\_interval\_BFD\_CCA}$.

When DRX is not used, $T_{Indication\_interval\_BFD\_CCA}$ is max(2ms, $T_{SSB-RS,M}$)), where $T_{SSB-RS,M}$ is the shortest periodicity of all RS resources in set $\bar{q}_0$ for the accessed cell, corresponding to either the shortest periodicity of the SSB in the set $\bar{q}_0$.

When DRX is used, for SSB based link quality measurement,

- $T_{Indication\_interval\_BFD\_CCA}$ = Max(1.5 × DRX_cycle_length, 1.5 × $T_{SSB-RS,M}$), if DRX_cycle_length ≤ 320ms,

- $T_{Indication\_interval\_BFD\_CCA}$ = DRX_cycle_length, if DRX_cycle_length > 320ms.

8.5A.5 Requirements for SSB based candidate beam detection

8.5A.5.1 Introduction

The requirements in this clause apply for each CBD-RS SSB resource in the set $\overline{q}_1$ configured for a serving cell, provided that the SSBs configured for candidate beam detection are actually transmitted within UE active DL BWP during the entire evaluation period specified in clause 8.5A.5.2.

8.5A.5.2 Minimum requirement

Upon request the UE shall be able to evaluate whether the L1-RSRP measured on the configured CBD-RS SSB resource in set $\overline{q}_1$ estimated over the last $T_{Evaluate\_CBD\_SSB\_CCA}$ ms period becomes better than the threshold Q_{in_LR} provided SSB_RP and SSB Ês/Iot are according to Annex Table B.2.4.1 for a corresponding band.

The UE shall monitor the configured SSB resources using the evaluation period in table 8.5A.5.2-1 corresponding to the non-DRX mode, if the configured DRX cycle ≤ 320ms.

The value of $T_{Evaluate\_CBD\_SSB\_CCA}$ is defined in Table 8.5A.5.2-1, where

- $P = \frac{1}{1-\frac{T_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CBD-RS SSB,
- P = 1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CBD-RS SSB.

Table 8.5A.5.2-1: Evaluation period $T_{Evaluate\_CBD\_SSB\_CCA}$

Configuration	$T_{Evaluate\_CBD\_SSB\_CCA}$ (ms)
non-DRX, DRX cycle ≤ 320ms	Max(25, Ceil((3 + L_{CBD}) × P) × T_{SSB})
DRX cycle > 320ms	Ceil((3 + L_{CBD}) × P) × T_{DRX}
Note 1: T_{SSB} is the periodicity of SSB in the set $\overline{q}_1$. T_{DRX} is the DRX cycle length. Note 2: L_{CBD} is the number of CBD-RS SSB occasions not available at the UE during $T_{Evaluate\_CBD\_SSB\_CCA}$ where $L_{BFD} \le L_{CBD,max}$. Note 3: $L_{CBD,max}$=7 for Max(T_{DRX}, T_{SSB}) ≤ 40 assuming T_{DRX}=0 for non-DRX, $L_{CBD,max}$=5 for 40 < Max(T_{DRX}, T_{SSB}) ≤ 320, $L_{CBD,max}$=3 for T_{DRX} > 320. Note 4 If L_{CBD}>$L_{CBD,max}$, UE assumes no new candidate beams found.	

8.5A.5.3 Measurement restriction for SSB based candidate beam detection

When the SSB for CBD measurement is in the same OFDM symbol as CSI-RS for BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for CBD measurement without any restrictions;
- If SSB and CSI-RS have different SCS-es,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for CBD measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for CBD measurement and CSI-RS. Longer measurement period for SSB based CBD measurement is expected, and no requirements are defined.

8.5A.7 Scheduling availability of UE during beam failure detection

Scheduling availability restrictions when the UE is performing beam failure detection are described in the following clauses.

8.5A.7.1 Scheduling availability of UE performing beam failure detection with a same subcarrier spacing as PDSCH/PDCCH

In this clause, the same requirements apply as in Clause 8.5.7.1.

8.5A.7.2 Scheduling availability of UE performing beam failure detection with a different subcarrier spacing than PDSCH/PDCCH

In this clause, the same requirements apply as in Clause 8.5.7.2.

8.5A.8 Scheduling availability of UE during candidate beam detection

Scheduling availability restrictions when the UE is performing L1-RSRP measurement for candidate beam detection are described in the following clauses.

8.5A.8.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH

In this clause, the same requirements apply as in Clause 8.5.8.1.

8.5A.8.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH

In this clause, the same requirements apply as in Clause 8.5.8.2.

8.6 Active BWP switch delay

8.6.1 Introduction

The requirements in this clause apply for a UE configured PCell or any activated SCell in standalone NR or NE-DC, PCell, PSCell or any activated SCell in MCG or SCG in NR-DC, or PSCell or any activated SCell in SCG in EN-DC. The requirements in this clause also apply for a UE configured with more than one BWP on PCell or any activated SCell with CCA in standalone NR, or PSCell or any activated SCell with CCA in SCG in EN-DC. The requirements in 8.6.4 apply for a UE which is capable of *ul-LBT-FailureDetectionRecovery-r16* configured with more than one UL BWP on PCell with CCA in standalone NR or PSCell with CCA in EN-DC.

UE shall complete the switch of active DL and/or UL BWP within the delay defined in this clause.

8.6.2 DCI and timer based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with more than one BWP configurations configured.

For DCI-based BWP switch, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n. Where,

- Y=0, if the serving cell where UE receives DCI for BWP switch request is same as the serving cell on which BWP switch occurs.

- Y=1, if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell. In this scenario, $T_{BWPswitchDelay}$ + Y shall follow the smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths.

For timer-based BWP switch, the UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (FR1) or DL half-subframe (FR2) immediately after a BWP-inactivity timer *bwp-InactivityTimer* [2] expires on a serving cell, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{BWPswitchDelay}$ which starts from the beginning of DL slot n.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{BWPswitchDelay}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

Table 8.6.2-1: BWP switch delay

μ	NR Slot length (ms)	BWP switch delay $T_{BWPswitchDelay}$ (slots)	
		Type 1[Note 1]	Type 2[Note 1]
0	1	1	3
1	0.5	2	5
2	0.25	3	9
3	0.125	6	18
Note 1: Depends on UE capability. Note 2: If the BWP switch involves changing of SCS, the BWP switch delay is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch.			

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in the new BWP.

- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in the new BWP.

If the BWP switch is triggered within or outside DRX active time, and one of the two BWPs in a BWP switching is a dormant BWP [TS 38.321, 7], UE shall be able to complete active BWP switching within

- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X$, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is receiveds, or

- $T_{dormantBWPswitchDelay} = T_{BWPswitchDelay} + X + Z$, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where

- $T_{BWPswitchDelay}$ is defined in Table 8.6.2-1 corresponding to the smaller value between the SCS of the serving cell where UE receives dormancy indication and the SCS of the serving cell where BWP switching occurs;

- X=1 slot corresponding to the smaller value between the SCS of the serving cell where UE receives dormancy indication and the SCS of the serving cell where BWP switching occurs.

- Z=1 slot corresponding to the SCS of the serving cell where UE receives dormancy indication.

Editor's Note: The requirements are defined in DCI-agnostic manner, if RAN1 defines something that makes Dormant switching time/interruption to always be absorbed into WUS gap, RAN4 can revise the specification text accordingly.

For DCI-based BWP switch, if the new BWP is a dormant BWP, after the UE receives BWP switching request at DL slot n on a serving cell, UE shall be able to receive CSI-RS (for DL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL slot occurs right after a time duration of $T_{dormantBWPswitchDelay}$ which starts from the beginning of DL slot n.

8.6.2A DCI based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (DCI based BWP switch) is performed on multiple CCs simultaneously or over partially overlapping time period.

8.6.2A.1 Simultaneous DCI based BWP switch delay on multiple CCs

The delay requirements for simultaneous DCI based BWP switch on multiple CCs in this clause apply only if the timing difference among the first symbol of slot carrying DCI for all CCs is received within the MRTD for inter-band CA as defined in clause 7.6.4.

For DCI-based BWP switch on multiple CCs, after the UE receives BWP switching request, UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelay}$ which starts from the beginning of DL slot n, where slot n is slot which UE receives the earliest BWP switching request among CCs on which UE is performing simultaneous DCI-based BWP switching.

The UE is not required to transmit UL signals or receive DL signals until the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelay}$ which starts from the beginning of DL slot n except DCI triggering BWP switch on the cell where DCI-based BWP switch occurs. The UE is not required to follow the requirements defined in this clause when performing a DCI-based BWP switch between the BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths on any serving cell.

UE shall finish BWP switch within the time duration $T_{MultipleBWPswitchDelay}$ if the serving cell where UE receives DCI for BWP switch is same as the serving cell on which BWP switch occurs for each involved serving cell, which is defined as:

$$T_{MultipleBWPswitchDelay} = T_{BWPswitchDelay} + D*(N-1)$$

Where:

- $T_{BWPswitchDelay}$ is the BWP switching delay on single CC defined in Table 8.6.2-1 depending on UE capability *bwp-SwitchingDelay* [2]. $T_{BWPswitchDelay}$ shall be based on the smallest SCS among SCS of all involved CCs before and after BWP switch. If the BWP switch on multiple CCs results in the change of the SCS on any CC among involved CCs, $T_{BWPswitchDelay}$ should be based on the smallest SCS among all SCS values of all involved CCs.

- D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability *bwp-SwitchingMultiCCs-r16* [13].

- For UE which is capable of per-FR gap, and no BWP switch involves SCS change, N is the number of CCs in same FR; For UE which is not capable of per-FR gap, or the BWP switches on any CC involves SCS changing, N is the number of CCs undergoing simultaneous BWP switch.

UE shall finish BWP switch within the time duration $T_{MultipleBWPswitchDelay}$ + Y if the serving cell where UE receives DCI for BWP switch is different from the serving cell on which BWP switch occurs for any involved serving cell, where Y equals to the length of one slot at smaller SCS of scheduling cell, scheduled cells before and scheduled cells after active BWP change.Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in the new BWP.
- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in the new BWP.

If the BWP switch is triggered on multiple CCs simultaneously within or outside DRX active time, and one of the two BWPs on each CC in a BWP switching is a dormant BWP [TS 38.321, 7], UE shall be able to complete active BWP switching within

- $T_{MultipleBWPswitchDelay}$+X, provided that the dormancy indication is received in any of the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, or
- $T_{MultipleBWPswitchDelay}$ +X+Z, provided that the dormancy indication is received after the first 3 OFDM symbols of a slot in the serving cell where DCI for dormancy indication is received, where
- $T_{MultipleBWPswitchDelay}$ is defined above corresponding to the smaller value between the SCS of the serving cell where UE receives dormancy indication and the SCS of the serving cell where BWP switching occurs;
- X=1 slot corresponding to the smaller value between the SCS of the serving cell where UE receives dormancy indication and the SCS of the serving cell where BWP switching occurs.
- Z=1 slot corresponding to the SCS of the serving cell where DCI for dormancy indication is received.

Editor's Note: The requirements are defined in DCI-agnostic manner, if RAN1 defines something that makes Dormant switching time/interruption to always be absorbed into WUS gap, RAN4 can revise the specification text accordingly.

8.6.2A.2 Non-simultaneous DCI based BWP switch delay on multiple CCs

In non-simultaneous case, the DCI-based BWP switch on multiple CCs is triggered over partially overlapping time period between CCs or multiple CCs in different Cell groups. The delay requirements for non-simultaneous DCI based BWP switch on multiple CCs in this clause apply only if:

- the timing difference among the first symbol of slot carrying DCI for all CCs involved in non-simultaneous BWP switch is received exceeds the MRTD for inter-band CA as defined in clause 7.6.4, and
- UE is operating in NR-DC (FR1+FR2), and
- UE is capable of per-FR gap, and
- BWP switch does not involve SCS change

For non-simultaneous DCI based BWP switch on multiple CCs, BWP switching delay requirements defined in clause 8.6.2 apply when BWP switching occurs on single CC in the cell group. BWP switching delay requirements defined in clause 8.6.2A.1 apply when simultaneous BWP switching occurs on multiple CCs in the cell group.

8.6.2B Timer based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (timer based BWP switch) is performed on multiple CCs simultaneously or over partially overlapping time period.

8.6.2B.1 Simultaneous timer based BWP switch delay on multiple CCs

The delay requirements for simultaneous timer based BWP switch on multiple CCs in this clause apply only if the timing difference among the beginning of the slot where timer based BWP switching starts for all CCs is within the MRTD for inter-band CA as defined in clause 7.6.4.

For timer-based BWP switch on multiple CCs, UE shall start BWP switch at DL slot n, where slot n is the first slot of a DL subframe (in FR1) or DL half-subframe ((in FR2) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* [2] expiration occurs on multiple serving cells, and the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelay}$ which starts from the beginning of DL slot n, where $T_{MultipleBWPswitchDelay}$ is defined in 8.6.2A.1.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{MultipleBWPswitchDelay}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in the new BWP.
- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in the new BWP.

8.6.2B.2 Non-simultaneous timer based BWP switch delay on multiple CCs

In non-simultaneous case, the timer-based BWP switch on multiple CCs is triggered over partially overlapping time period.

The delay requirements for non-simultaneous timer based BWP switch on multiple CCs in this clause apply if the timing difference among the beginning of the slot where timer based BWP switching starts for all CCs is exceeds the MRTD for inter-band CA as defined in clause 7.6.4, and the BWP switch does not involve SCS change. The UE performs the non-simultaneous timer-based BWP switch on the CCs sequentially.

For non-simultaneous timer-based BWP switch, the UE shall be able to receive PDSCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch on the first DL or UL slot occurs right after a time duration of $T_{MultipleBWPswitchDelayTotal}$ which starts from the beginning of DL slot n, where slot n is the first slot of a DL subframe (in FR1) or DL half-subframe (in FR2) immediately after the earliest BWP-inactivity timer *bwp-InactivityTimer* [2] expires.

$$T_{MultipleBWPswitchDelayTotal} = T_{Delay} + T_{MultipleBWPswitchDelay}$$

Where:

T_{Delay} is the time required to complete the ongoing timer-based BWP switching on other CCs.

$T_{MultipleBWPswitchDelay}$ is the timer-based BWP switch delay on current single CC defined in clause 8.6.2 or simultaneously triggered on multiple CCs defined in clause 8.6.2B.1.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{MultipleBWPswitchDelayTotal}$ after *bwp-InactivityTimer* [2] expires on the cell where timer-based BWP switch occurs.

Provided the UE does not have the required TCI-state information to receive PDCCH and PDSCH in the new BWP, the UE shall use old TCI-states before the BWP switch until a new MAC CE updating the required TCI-state information for PDCCH and PDSCH is received after the BWP switch.

If UE has the information on the required TCI-state information to receive PDCCH and PDSCH in the new BWP,

- UE shall be able to receive PDCCH and PDSCH with old TCI-states before the delay as specified in Clause 8.10 in the new BWP.
- UE shall be able to receive PDCCH and PDSCH with new TCI-states after the delay as specified in Clause 8.10 in the new BWP.

8.6.3 RRC based BWP switch delay on a single CC

The requirements in this clause only apply to the case that the BWP switch is performed on a single CC with one or more than one BWP configuration(s) configured.'

Editor's note: FFS if RRC based BWP switch is applicable to SCell.

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWP, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWP on the serving cell on which BWP switch occurs on the first DL or UL slot right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command, and

$NR\ Slot\ length$ is determined by the smaller SCS between the SCS before BWP switch and the SCS after BWP switch if the BWP switch involves changing of SCS.

$T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in ms as defined in clause 12 in TS 38.331 [2], and

$T_{BWPswitchDelayRRC} = 6ms$ is the time used by the UE to perform BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC}$ on the cell where RRC-based BWP switch occurs. When $T_{HARQ} > T_{RRCprocessingDelay}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.6.3A RRC based BWP switch delay on multiple CCs

The requirements in this clause only apply to the case when the same type of BWP switch (RRC based BWP switch) is performed on multiple CCs simultaneously or over partially overlapping time period.

8.6.3A.1 Simultaneous RRC based BWP switch delay on multiple CCs

Requirements in this clause apply only if RRC based BWP switching on multiple CCs for NR-CA is triggered by a single RRC command.

For RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWPs, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch occurs on the first DL or UL slot right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}*(N-1)}{NR\ slot\ length}$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command, and

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3, and

$D_{RRC} = 0$ for UE which is capable of type 1 BWP switching delay depending on UE capability *bwp-SwitchingDelay* [2]. $D_{RRC} = D$ for UE which is capable of type 2 BWP switching delay depending on UE capability *bwp-SwitchingDelay* [2], where D is the incremental delay for each additional CC involved in simultaneous BWP switch and depends on UE capability [13].

N is the number of CCs within the NR-CA configured for performing simultaneous BWP switch.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC} + D_{RRC} * (N-1)$ on the cells where RRC-based BWP switch occurs.

8.6.3A.2 Non-simultaneous RRC based BWP switch delay on multiple CCs

In non-simultaneous case, the RRC-based BWP switch on multiple CCs is triggered over partially overlapping time period in different Cell groups. The delay requirements in this clause apply only if:

BWP switching on multiple CCs in different cell groups are triggered by separate RRC commands, and

UE is operating in NR-DC (FR1+FR2), and

UE is capable of per-FR gap, and

BWP switch does not involve SCS change.

For non-simultaneous RRC-based BWP switch, after the UE receives RRC reconfiguration involving active BWP switching or parameter change of its active BWPs, UE shall be able to receive PDSCH/PDCCH (for DL active BWP switch) or transmit PUSCH (for UL active BWP switch) on the new BWPs on the serving cells on which BWP switch occurs on the first DL or UL slot right after a time duration of $\frac{T_{Waiting}+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}+D_{RRC}*(M-1)}{NR\ slot\ length}$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command,

$T_{Waiting}$ is the waiting time for RRC based BWP switch which is upper bounded by the ongoing BWP switch time in the first CG defined in clause 8.6.3A.1,

M is the number of CCs within the NR-CA configured for performing simultaneous BWP switch in the second CG; M=1 if the BWP switch is performed on single CC,

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3, and

D_{RRC} is defined in clause 8.6.3A.1.

The UE is not required to transmit UL signals or receive DL signals during the time defined by $T_{RRCprocessingDelay} + T_{BWPswitchDelayRRC} + D_{RRC} * (M-1)$ on the cells in the second CG where RRC-based BWP switch occurs.

8.6.4 BWP switch delay on Consistent UL LBT recovery

Upon detection of consistent UL LBT failure is slot#n in SpCell when UE detects *lbt-FailureInstanceMaxCount* number of LBT failure within *lbt-FailureDetectionTimer*, the UE shall switch the active UL BWP to an UL BWP configured with PRACH occasion and for which consistent LBT failure has not been triggered as defined in TS 38.321 clause 5.21 [7]. The UE shall be ready to transmit PRACH on the new UL BWP of the SpCell on the first UL slot occurs right after slot n+$T_{BWPswitchDelay}$ +1, where $T_{BWPswitchDelay}$ is defined in Table 8.6.2-1. The UE shall finish the UL BWP switch within the time duration $T_{BWPswitchDelay}$ depending on UE capability *bwp-SwitchingDelay* [2].

Note: Additional delay in acquiring the first available RACH occasion will be derived in a way similar to that in handover in clause 6.1B.1.

The UE is not required to transmit UL signals or receive DL signals during time duration $T_{BWPswitchDelay}$ on the SpCell in the UL BWP switch. The UE is not required to follow the requirements defined in this clause when performing a UL BWP switch between the UL BWPs in disjoint channel bandwidths or in partially overlapping channel bandwidths.

8.7 Void

8.8 NE-DC: E-UTRAN PSCell Addition and Release Delay

8.8.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to configure an E-UTRAN PSCell in NR - E-UTRA dual connectivity. The requirements are applicable to an NR - E-UTRA dual connectivity capable UE.

8.8.2 E-UTRAN PSCell Addition Delay Requirement

The requirements in this clause shall apply for the UE, which is configured with PCell, and may also be configured with one or more SCells.

Upon receiving E-UTRAN PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards E-UTRAN PSCell no later than in subframe *n* + $T_{config\_EUTRAN\text{-}PSCell}$:

Where:

$T_{config\_EUTRAN\text{-}PSCell}$ = 20ms + $T_{activation\_time}$ + 50ms + T_{PCell_DU} + $T_{E\text{-}UTRAN\text{-}PSCell\_DU}$

$T_{activation\_time}$ is the E-UTRAN PSCell activation delay. If the E-UTRAN PSCell is known, then $T_{activation\_time}$ is 20ms. If the E-UTRAN PSCell is unknown, then $T_{activation\_time}$ is 30ms provided the E-UTRAN PSCell can be successfully detected on the first attempt.

T_{PCell_DU} is the delay uncertainty due to PCell PRACH preamble transmission. T_{PCell_DU} is up to 20ms if E-UTRAN PSCell activation is interrupted by a PCell PRACH preamble transmission, otherwise it is 0.

$T_{E\text{-}UTRAN\text{-}PSCell\_DU}$ is the delay uncertainty in acquiring the first available PRACH occasion in the E-UTRAN PSCell. $T_{E\text{-}UTRAN\text{-}PSCell\_DU}$ is up to 30ms.

E-UTRAN PSCell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the E-UTRAN PSCell configuration command:
  - the UE has sent a valid measurement report for the E-UTRAN PSCell being configured and
  - the E-UTRAN PSCell being configured remains detectable according to the cell identification conditions specified in clause 8.8 of TS 36.133 [15],
- E-UTRAN PSCell being configured also remains detectable during the E-UTRAN PSCell configuration delay $T_{config\_EUTRAN\text{-}PSCell}$ according to the cell identification conditions specified in clause 8.8 of TS 36.133 [15].

otherwise it is unknown.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.8.3 E-UTRAN PSCell Release Delay Requirement

The requirements in this clause shall apply for a UE which is configured with PCell and E-UTRAN PSCell and may also be configured with one or more SCells and/or E-UTRAN SCells.

Upon receiving E-UTRAN PSCell release in subframe *n*, the UE shall accomplish the release actions specified in TS 38.331 [2] no later than in subframe *n*+20.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.9 NR-DC: PSCell Addition and Release Delay

8.9.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to configure an PSCell in NR dual connectivity. The requirements are applicable to an NR dual connectivity capable UE.

8.9.2 PSCell Addition Delay Requirement

The requirements in this clause shall apply for the UE configured with only PCell in FR1.

Upon receiving PSCell addition in subframe *n*, the UE shall be capable to transmit PRACH preamble towards PSCell in FR2 no later than in subframe $n + T_{config\_PSCell}$:

where:

$T_{config\_PSCell} = T_{RRC\_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell\_DU} + 2$ ms

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

$T_{processing}$ is the SW processing time needed by UE, including RF warm up period. $T_{processing}$ = 40 ms.

T_{search} is the time for AGC settling and PSS/SSS detection. If the target cell is known, T_{search} = 0 ms. If the target cell is unknown and the target cell $\hat{E}s/Iot \geqslant -2$dB, T_{search} = 24* Trs ms.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. T_{Δ} = 1*Trs ms for a known or unknown PSCell.

T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in Table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

In FR1 and FR2, the PSCell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the PSCell configuration command:
  - the UE has sent a valid measurement report for the PSCell being configured and
  - One of the SSBs measured from the PSCell being configured remains detectable according to the cell identification conditions specified in clause 9.3.
- One of the SSBs measured from PSCell being configured also remains detectable during the PSCell configuration delay T_{config_PSCell} according to the cell identification conditions specified in clause 9.3.

otherwise it is unknown.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.9.3 PSCell Release Delay Requirement

The requirements in this clause shall apply for a UE which is configured with PCell and one PSCell.

Upon receiving PSCell release in subframe *n*, the UE shall accomplish the release actions specified in TS 38.331 [2] no later than in subframe $n+ T_{RRC\_delay}$:

where

T_{RRC_delay} is the RRC procedure delay as specified in TS 38.331 [2].

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.10 Active TCI state switching delay

8.10.1 Introduction

The requirements in this clause apply for a UE configured with one or more TCI state configurations on serving cell in MR-DC or standalone NR. UE shall complete the switch of active TCI state within the delay defined in this clause.

8.10.2 Known conditions for TCI state

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state
  - TCI state switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement
  - The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command
  - The TCI state remains detectable during the TCI state switching period
  - The SSB associated with the TCI state remain detectable during the TCI switching period

- SNR of the TCI state ≥ -3dB

Otherwise, the TCI state is unknown.

8.10.3 MAC-CE based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ TO_k*($T_{first-SSB}$ + $T_{SSB-proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$ .Where T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3];

- $T_{first-SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state
- $T_{SSB-proc}$ = 2 ms;
- TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE activation command in slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$ + $T_{L1-RSRP}$ +TO_{uk}*($T_{first-SSB}$+ $T_{SSB-proc}$) / *NR slot length*. The UE shall be able to receive PDCCH with the old TCI state until slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$.

Where

- $T_{L1-RSRP}$ = 0 in FR1 or when the TCI state switching not involving QCL-TypeD in FR2. Otherwise,
- $T_{L1-RSRP}$ is the time for Rx beam refinement in FR2, defined as
- $T_{L1-RSPR\_Measurement\_Period\_SSB}$ for SSB as specified in clause 9.5.4.1,
  - with the assumption of M=1
  - with T_{Report} = 0
- $T_{L1-RSRP\_Measurement\_Period\_CSI-RS}$ for CSI-RS as specified in clause 9.5.4.2
  - configured with higher layer parameter *repetition* set to ON
  - with the assumption of M=1 for periodic CSI-RS
  - for aperiodic CSI-RS if number of resources in resource set at least equal to *MaxNumberRxBeam*
  - with T_{Report} = 0
- TO_{uk} = 1 for CSI-RS based L1-RSRP measurement, and 0 for SSB based L1-RSRP measurement when TCI state switching involves QCL-TypeD
- TO_{uk} = 1 when TCI state switching involves other QCL types only
- $T_{first-SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{first-SSB}$ is time to first SSB transmission after MAC CE command is decoded by the UE for other QCL types;

- The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

8.10.4 DCI based TCI state switch delay

If the target TCI state is known, when a UE is configured with the higher layer parameter *tci-PresentInDCI* which is set as 'enabled' for the CORESET scheduling PDSCH at slot n, UE shall be able to receive PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+*timeDurationForQCL*, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.331 [2].

The known condition for TCI state defined in clause 8.10.2 is applied.

8.10.5 RRC based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying RRC activation command at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC\_processing}$ +TO_k*($T_{first-SSB}$ + $T_{SSB-proc}$)) / *NR slot length*, where $T_{RRC\_processing}$ is the RRC processing delay defined in Clause 12 of TS 38.331 [2], $T_{first-SSB}$, $T_{SSB-proc}$ and TO_k are defined in clause 8.10.3. The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

- $T_{first-SSB}$ is time to first SSB transmission after RRC processing by the UE; The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state.

If the target TCI state is unknown, upon receiving PDSCH carrying RRC activation command at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC\_processing}$ +$T_{L1-RSRP}$ +TO_{uk}*($T_{first-SSB}$ + $T_{SSB-proc}$)) / *NR slot length*, where $T_{RRC\_processing}$ is the RRC processing delay defined in Clause 12 of TS 38.331 [2], and TO_{uk} , $T_{L1-RSRP}$ are defined in clause 8.10.3. The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

- $T_{first-SSB}$ is time to first SSB transmission after L1-RSRP measurement when TCI state switching involves QCL-TypeD;
- $T_{first-SSB}$ is time to first SSB transmission after RRC processing time at the UE for other QCL types;
  - The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list. When $T_{HARQ} > T_{RRC\_processing}$ a longer switching delay is allowed. Where T_{HARQ} is the time between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.10.6 Active TCI state list update delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n+ T_{HARQ} +$3N_{slot}^{subframe,\mu}$ +TO_k*($T_{first-SSB}$ + $T_{SSB-proc}$) / *NR slot length*. Where T_{HARQ}, $T_{first-SSB}$, $T_{SSB-proc}$ and TO_k are defined in clause 8.10.3.

8.10A Active TCI state switching delay with CCA

8.10A.1 Introduction

The requirements in this clause apply for a UE configured with one or more TCI state configurations on serving cell in EN-DC with PSCell on a carrier frequency with CCA or SA NR with PCell on a carrier frequency with CCA. UE shall complete the switch of active TCI state within the delay defined in this clause.

In the requirements of clause 8.10A, the term SSB occasion not available at the UE refers to when the SSB is configured by gNB in a cell on a carrier frequency subject to CCA, but the first two successive candidate SSB positions for the same SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period; otherwise the SSB occasion is considered as available at the UE.

8.10A.2 Known conditions for TCI state

The TCI state is known if the following conditions are met:

- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of active TCI state switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state

- TCI state switch command is received within 1280 ms of the last transmission of the RS resource for beam reporting or measurement
- The UE has sent at least 1 L1-RSRP report for the target TCI state before the TCI state switch command
- The TCI state remain detectable during the TCI state switching period in the SSB occasions available at the UE
- The SSB associated with the TCI state remain detectable during the TCI switching period in the SSB occasions available at the UE
  - SNR of the TCI state is ≥ -3dB

Otherwise, the TCI state is unknown.

8.10A.3 MAC-CE based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE activation command at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ $3N_{\text{slot}}^{\text{subframe},\mu}$ +(T_{HARQ} +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$+T_{SSB}*$L_{MAC,known}$)) */NR slot length*. The UE shall be able to receive on the old TCI state until slot n + $3N_{\text{slot}}^{\text{subframe},\mu}$ + (T_{HARQ} +TO_k*($T_{first\text{-}SSB}$+ T_{SSB}*$L_{MAC,known}$)) / *NR slot length*, where

T_{HARQ} (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3]. In the event of UE not being able to transmit the acknowledgment due to UL CCA failures: T_{HARQ} is extended to also include the time to all next HARQ feedback transmissions and retransmission opportunities, until the time of its successful transmission, as specified in TS 38.213 [3]; no extension of T_{HARQ} due to UL LBT failures is allowed for Type 2C UL channel access in TS 37.213;

$T_{first\text{-}SSB}$ is time to first SSB transmission occasion after MAC CE command is decoded by the UE, during which some SSB occasions may not be available at the UE due to DL CCA failures;

The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state;

$T_{SSB\text{-}proc}$ = 2 ms;

TO_k = 1 if target TCI state is not in the active TCI state list for PDSCH, 0 otherwise;

T_{SSB} = ssb-periodicityServingCell;

$L_{MAC,known} \leq L_{MAC,known,max}$ is the corresponding number of SSB occasions not available at the UE;

$L_{MAC,known,max}$ =2 for $T_{SSB} \leq 40$ ms, $L_{MAC,known,max}$ =1 for $T_{SSB} > 40$ ms.

If the target TCI state is unknown, upon receiving PDSCH carrying MAC-CE activation command at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ $3N_{\text{slot}}^{\text{subframe},\mu}$ + (T_{HARQ} +TO_{uk}*($T_{first\text{-}SSB}$+ $T_{SSB\text{-}proc}$+T_{SSB}*$L_{MAC,unknown}$)) / *NR slot length* . The UE shall be able to receive on the old TCI state until slot n+ $3N_{\text{slot}}^{\text{subframe},\mu}$ + (T_{HARQ}+TO_{uk}*($T_{first\text{-}SSB}$+ T_{SSB}*$L_{MAC,unknown}$)) / *NR slot length*, where:

$L_{MAC,unknown} \leq L_{MAC,unknown,max}$ is the corresponding number of SSB occasions not available at the UE;

$L_{MAC,unknown,max}$ = 2 for $T_{SSB} \leq 40$ ms, $L_{MAC,unknown,max}$ = 1 for $T_{SSB} > 40$ ms;

TO_{uk} = 1.

8.10A.4 DCI based TCI state switch delay

If the target TCI state is known, when a UE is configured with the higher layer parameter *tci-PresentInDCI* which is set as 'enabled' for the CORESET scheduling the PDSCH at slot n, UE shall be able to receive PDSCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+*timeDurationForQCL*, where, *timeDurationForQCL* is the time required by the UE to perform PDCCH reception and applying spatial QCL information received in DCI for PDSCH processing as described in TS 38.214 [26], the value of *timeDurationForQCL* is defined in TS 38.306 [14].

The known condition for TCI state defined in clause 8.10A.2 is applied.

8.10A.5 RRC based TCI state switch delay

If the target TCI state is known, upon receiving PDSCH carrying RRC activation command at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC\_processing}$ +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$+ T_{SSB}*$L_{RRC,known}$)) / *NR slot length*, where $T_{RRC\_processing}$ is the RRC processing delay defined in Clause 12 of TS38.331 [2], $T_{first\text{-}SSB,}$ $T_{SSB\text{-}proc}$,TO_k, T_{SSB} are as defined in clause 8.10A.3. The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

$T_{first\text{-}SSB}$ is time to first SSB transmission occasion after RRC processing by the UE, during which some of the SSB occasions may not be availabledue to DL CCA failures;

The SSB shall be the QCL-TypeA or QCL-TypeC to target TCI state;

$L_{RRC,known} \leq L_{RRC,known,max}$ is the corresponding number of SSB occasions not available at the UE;

$L_{RRC,known,max}$ =2 for T_{SSB}≤40 ms, $L_{RRC,known,max}$ =1 for T_{SSB}>40 ms.

If the target TCI state is unknown, upon receiving PDSCH carrying RRC activation command at slot n, UE shall be able to receive PDCCH with target TCI state of the serving cell on which TCI state switch occurs at the first slot that is after slot n+ ($T_{RRC\_processing}$ + TO_{uk}*($T_{first\text{-}SSB}$+ $T_{SSB\text{-}proc}$+T_{SSB}*$L_{RRC,unknown}$)) / *NR slot length*, where $T_{RRC\_processing}$ is the RRC processing delay defined in Clause 12 of TS38.331 [2], TO_{uk}, $T_{SSB\text{-}proc}$, T_{SSB} are as defined in clause 8.10A.3. The UE is not required to receive PDCCH/PDSCH/CSI-RS or transmit PUCCH/PUSCH until the end of switching period.

$T_{first\text{-}SSB}$ is time to first SSB transmission occasion after L1-RSRP measurement when TCI state switching involves QCL-TypeD, during which some SSB occasions may not be available at the UE due to DL CCA failures;

$T_{first\text{-}SSB}$ is time to first SSB transmission occasion after RRC processing time at the UE for other QCL types, during which some SSB occasions may not be available at the UE due to DL CCA failures;

$L_{RRC,unknown} \leq L_{RRC,unknown,max}$ is the corresponding number of SSB occasions not available at the UE;

$L_{RRC,unknown,max}$ = 2 for T_{SSB} ≤40 ms, $L_{MAC,unknown,max}$ = 1 for T_{SSB}>40 ms.

The requirements for RRC based TCI state switch delay apply when only 1 TCI state is configured in RRC TCI state list.

8.10A.6 Active TCI state list update delay

If the target TCI state is known, upon receiving PDSCH carrying MAC-CE active TCI state list update at slot n, UE shall be able to receive PDCCH to schedule PDSCH with the new target TCI state at the first slot that is after n + $3N_{slot}^{subframe,\mu}$ + (T_{HARQ} +TO_k*($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$+T_{SSB}*$L_{MAC,known}$)) / *NR slot length*. Where T_{HARQ}, $T_{first\text{-}SSB,}$ $T_{SSB\text{-}proc}$, T_{SSB}, $L_{MAC,known}$ and TO_k are as defined in clause 8.10A.3.

8.11 PSCell Change

This clause defines requirements for the delay within which the UE shall be able to change PSCell to other SCell in EN-DC or NR-DC. The requirements in this clause are applicable to EN-DC and NR-DC.

Upon receiving PSCell change in subframe *n*, the UE shall be capable of transmitting PRACH preamble towards the target PSCell no later than specified in clause 8.9.2, where the following value for $T_{processing}$ shall override the existing one:

- $T_{processing}$ = 20 ms when source and target cells are in the same FR,
- $T_{processing}$ = 40 ms when source and target cells are in different FRs.

The target PSCell is known if it has been meeting the conditions in clause 8.9.2.

The PCell interruption specified in clause 8.2 is allowed only during the RRC reconfiguration procedure [2].

8.11A void

8.11B Conditional PSCell Change

8.11B.1 Introduction

This clause defines requirements for the delay within which the UE shall be able to perform conditional PSCell change in EN-DC or NR-DC. The requirements in this clause are applicable to EN-DC and NR-DC.

8.11B.2 Conditoinal PSCell Change delay

The requirements in this clause shall apply for the UE configured with only PCell in FR1.

Upon receiving conditional PSCell change in subframe *n*, the UE shall be capable to transmit PRACH preamble towards the new target PSCell no later than in subframe n + $T_{config\_PSCell\_Conditional}$:

Where:

$T_{config\_PSCell\_Conditional} = T_{RRC\_processing} + T_{Event\_DU} + T_{measure} + T_{UE\_preparation} + T_{processing} + T_{\Delta} + T_{PSCell\_DU} + 2$ ms

T_{RRC_delay} is the RRC procedure delay for processing the conditional PSCell change commandas defined in TS 38.331 [2].

T_{Event_DU} is the delay uncertainty which is the time from when the UE successfully decodes a conditional PSCell change command until a condition exists at the measurement reference point which will trigger the conditional PSCell change.

$T_{measure}$ is the measurements time stated in clause 8.11B.2.1.

$T_{UE\_preparation}$ is the UE preparation time for conditional PSCell change, and starts after UE realizes the condition of PSCell change is met and identity of new PSCell is determined. $T_{UE\_preparation}$ is up to 10ms.

$T_{processing}$ is the SW processing time needed by UE, including RF warm up period. $T_{processing}$ = 20 ms when source and target cells are in the same FR, and $T_{processing}$ = 40 ms when source and target cells are in different FRs.

T_{Δ} is time for fine time tracking and acquiring full timing information of the target cell. T_{Δ} = 1*Trs ms.

T_{PSCell_DU} is the delay uncertainty in acquiring the first available PRACH occasion in the PSCell. T_{PSCell_DU} is up to the summation of SSB to PRACH occasion association period and 10 ms. SSB to PRACH occasion associated period is defined in Table 8.1-1 of TS 38.213 [3].

Trs is the SMTC periodicity of the target cell if the UE has been provided with an SMTC configuration for the target cell in PSCell addition message, otherwise Trs is the SMTC configured in the measObjectNR having the same SSB frequency and subcarrier spacing. If the UE is not provided SMTC configuration or measurement object on this frequency, the requirement in this clause is applied with Trs = 5 ms assuming the SSB transmission periodicity is 5 ms. There is no requirement if the SSB transmission periodicity is not 5 ms.

The PCell interruption specified in clause 8.2 is allowed only after the UE starts to execute a conditional PSCell change.

8.11B.2.1 Measurement time

The measurement time delay is defined from the end of T_{Event_DU} until UE executes a PSCell change to a target cell and interruption time starts.

For intra-frequency PSCell change, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify\_intra\_without\_index}$ defined in clause 9.2.5.1 or clause 9.2.6.2.

For inter-frequency PSCell change, the measurement time delay measured without Time To Trigger (TTT) and L3 filtering shall be less than $T_{identify\_inter\_without\_index}$ or $T_{identify\_inter\_with\_index}$ defined in clause 9.3.4. When TTT or L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index}$ for intra-frequency PSCell change or the time period $T_{identify\_inter\_without\_index}$ or $T_{identify\_inter\_with\_index}$ for inter-frequency PSCell change. If a cell, which has been detectable at least for the time period $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index}$ for intra-frequency PSCell change or the time period $T_{identify\_inter\_without\_index}$ or $T_{identify\_inter\_with\_index}$ for inter-frequency PSCell change, becomes undetectable for a period and then the cell becomes detectable again and triggers a PSCell change, the measurement time delay shall be less than $T_{SSB\_measurement\_period\_intra}$ or $T_{SSB\_measurement\_period\_inter}$ provided the timing to that cell has not changed more than ± 3200 Tc while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

8.12 Uplink spatial relation switch delay

8.12.1 Introduction

The requirements in this clause apply for a UE configured with one or more spatial relation configurations on serving cell in MR-DC or standalone NR. There is no requirement when the UE is requested to switch to a spatial relation with the higher layer parameter *spatialRelationInfo* associated to SRS. UE shall complete the switch of active spatial relation within the delay defined in this clause when the UE is requested to switch to a spatial relation with the higher layer parameter *spatialRelationInfo* associated to a DL RS.

8.12.2 Known conditions for spatial relation when associated with DL-RS

The spatial relation associated to DL RS is known if the following conditions are met:

- During the period from the last transmission of the DL RS resource used for the L1-RSRP measurement reporting for the target spatial relation to the completion of active spatial relation, where the DL RS resource for L1-RSRP measurement is the DL RS in target spatial relation or QCLed to the target spatial relation with QCL type-D.
    - Spatial relation switch command is received within 1280 ms upon the last transmission of the DL RS resource for beam reporting or measurement
    - The UE has sent at least 1 L1-RSRP report for the target spatial relation before the spatial relation switch command
    - The DL RS configured in spatial relation remains detectable during the spatial relation switching period
        - SNR of the DL RS configured in spatial relation ≥ -3dB
    - The SSB associated with the spatial relation remain detectable during the spatial relation switching period
        - SNR of the SSB associated with the spatial relation ≥ -3dB

Otherwise, the spatial relation is unknown.

8.12.3 MAC-CE based spatial relation switch delay

If the target spatial relation associated to DL RS is known, upon receiving PDSCH carrying MAC-CE activation command in slot n, for UL spatial relation switch for PUCCH or semi-persistent SRS transmission of serving cell with a target UL spatial relation, the UE shall be able to transmit PUCCH or semi-persistent SRS with the target UL spatial relation in the slot n+ T_{HARQ} + $3N_{slot}^{subframe,\mu}$+ 1 when *beamCorrespondenceWithoutUL-BeamSweeping* sets to 1 where T_{HARQ} is the timing between DL data transmission and acknowledgement as specified in TS 38.213 [3].

8.12.4 DCI based spatial relation switch delay

If the target spatial relation associated to DL RS is known, when a UE receives the DCI triggering aperiodic SRS at slot n with the higher layer parameter *spatialRelationInfo*, UE shall be able to transmit aperiodic SRS with target spatial relation of the serving cell on which spatial relation switch occurs in the slot $\left\lfloor n \cdot \frac{2^{\mu_{SRS}}}{2^{\mu_{PDCCH}}} \right\rfloor + k$ +1, where, k is configured via higher layer parameter *slotOffset*[2] for each triggered SRS resources set and is based on the subcarrier spacing of the triggered SRS transmission, μ_{SRS} and μ_{PDCCH} are the subcarrier spacing configurations for triggered SRS and PDCCH carrying the triggering command respectively in TS 38.214 [26].

The known condition for spatial relation associated to DL RS defined in clause 8.12.2 is applied.

8.12.5 RRC based spatial relation switch delay

If the target spatial relation associated to DL RS is known, upon receiving PDSCH carrying RRC activation command at slot n, UE shall be able to transmit target periodic SRS with spatial relation of the serving cell on which periodic SRS with spatial relation reconfigured in the slot n+ $T_{RRC\_processing}$ /*NR slot length* +1 when *beamCorrespondenceWithoutUL-BeamSweeping* sets to 1 where $T_{RRC\_processing}$ is the RRC processing delay defined in TS38.331 [2].

8.13 UE-specific CBW change

8.13.1 Introduction

The requirements in this clause apply for a UE receives reconfiguration of *offsetToCarrier* or *carrierBandwidth* to change channel bandwidth.

8.13.2 UE-specific CBW change delay

After the UE receives RRC reconfiguration involving *offsetToCarrier* or *carrierBandwidth* change on the old CBW, UE shall be able to receive PDSCH/PDCCH on an active DL BWP or transmit PUSCH on an active UL BWP of the new CBW right after a time duration of $\frac{T_{RRCprocessingDelay}+T_{CBWchangeDelayRRC}}{NR\ Slot\ length}$ slots which begins from the beginning of DL slot n, where

DL slot n is the last slot containing the RRC command, and

$T_{RRCprocessingDelay}$ is the length of the RRC procedure delay in millisecond as defined in clause 12 in TS 38.331 [2], and

$T_{CBWchangeDelayRRC} = 6ms$ is the time used by the UE to perform CBW change.

8.14 Pathloss reference signal switching delay

8.14.1 Introduction

The requirements in this clause apply for pathloss reference signal activated or updated on serving cell in MR-DC or standalone NR in clause 7.1.1 in TS 38.213 [3].

UE shall complete the switch of pathloss reference signal within the delay defined in this clause.

8.14.2 Known conditions for pathloss reference signal

The pathloss reference signal is known if the following conditions are met during the period between the last transmission of the L1-RSRP measurement reporting for the target pathloss reference signal and the completion of pathloss reference signal switch.

- Pathloss reference signal switch command is received within 1280 ms upon the last transmission of the target pathloss reference signal resource for beam reporting or measurement

- The UE has sent at least 1 L1-RSRP report for the target pathloss reference signal before the pathloss reference signal switch command
- The target pathloss reference signal remains detectable during the pathloss reference signal switching period
  - SNR of the target pathloss reference signal ≥-3dB
- The associated SSBs with the target pathloss reference signal remain detectable during the pathloss reference signal switching period
  - SNR of the associated SSB ≥-3dB

Otherwise, the pathloss reference signal is unknown.

8.14.3 MAC-CE based pathloss reference signal switch delay

The requirements in this clause apply for a UE to update a pathloss reference signal by MAC-CE for PUCCH, PUSCH, semi-persistent SRS and aperiodic SRS.

If the target pathloss reference signal is known, upon receiving PDSCH carrying MAC-CE activation in slot n, UE shall be able to apply the target pathloss reference signal of the serving cell on which pathloss reference signal switch occurs no later than the slot $n + T_{HARQ} + \left\lceil \frac{3\text{ms} + 5*T_{target\_PL-RS} + 2\text{ms}}{NR\ slot\ length} \right\rceil$. The UE shall be able to apply old pathloss reference signals until the slot n + T_{HARQ} + $3N_{\text{slot}}^{\text{subframe},\mu}$. Where

- T_{HARQ} is the timing between pathloss reference MAC-CE activation command and acknowledgement as specified in TS 38.321 [7].
- T_{target_PL-RS} is the periodicity of the target pathloss reference signal which would be SSB or NZP CSI-RS.

Note: longer application time is expected if measurement sample is not available due to measurement gap, DRX or other UE activities.

Note: longer application time is expected if the pathloss reference signal is unknown.

9 Measurement Procedure

9.1 General measurement requirement

9.1.1 Introduction

This clause contains general requirements on the UE regarding measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency, inter-frequency, inter-RAT E-UTRAN FDD, inter-RAT E-UTRAN TDD, and L1-RSRP measurements requirements. These measurements may be used by the NG-RAN. The measurement quantities are defined in TS38.215 [4], the measurement model is defined in TS38.300 [10], TS37.340 [17] and measurement accuracies are specified in clause 10. Control of measurement reporting is specified in TS 38.331 [2].

In the requirements of clause 9, the exceptions for side conditions apply as follows:

- for the UE capable of CA but not configured with any SCell, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.1 for UE supporting CA in FR1, and clause B.3.2.3 for UE supporting CA in FR2, respectively;
- for the UE capable of CA and configured with at least one SCell, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.2 for UE configured with CA in FR1, and clause B.3.2.4 for UE supporting CA in FR2, respectively;
- for the UE capable of SUL but not configured with SUL, the applicable exceptions for side conditions are specified in Annex B, clause B.3.4.1 for UE supporting SUL in FR1;

- for the UE capable of SUL and configured with at least one SUL, the applicable exceptions for side conditions are specified in Annex B, clause B.3.4.2 for UE configured with SUL in FR1.

9.1.2 Measurement gap

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE does not support independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network must provide a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers.

If the UE requires measurement gaps to identify and measure intra-frequency cells and/or inter-frequency cells and/or inter-RAT E-UTRAN cells, and the UE supports independent measurement gap patterns for different frequency ranges as specified in Table 5.1-1 in [18, 19, 20], in order for the requirements in the following clauses to apply the network must provide either per-FR measurement gap patterns for frequency range where UE requires per-FR measurement gap for concurrent monitoring of all frequency layers of each frequency range independently, or a single per-UE measurement gap pattern for concurrent monitoring of all frequency layers of all frequency ranges.

If the UE is configured via LPP [34] to measure PRS for any RSTD, PRS-RSRP, and UE Rx-Tx time difference measurement defined in TS 38.215 [4], in order for the requirements in clauses 9.9.2, 9.9.3, and 9.9.4 to apply, the network must provide

- a single per-UE measurement gap pattern for concurrent monitoring of all positioning frequency layers and intra-frequency, inter-frequency and/or inter-RAT frequency layers of all frequency ranges, or
- for measurement gap patterns other than #24 and #25, if UE supports independent measurement gap patterns for different frequency ranges, per-FR measurement gap pattern for the frequency range for concurrent monitoring of all positioning frequency layers and intra-frequency, inter-frequency cells and/or inter-RAT frequency layers in the corresponding frequency range.

During the per-UE measurement gaps the UE:

- is not required to conduct reception/transmission from/to the corresponding E-UTRAN PCell, E-UTRAN SCell(s) and NR serving cells for E-UTRA-NR dual connectivity except the reception of signals used for RRM measurement(s) and the signals used for random access procedure according to TS38.321 [7].
- is not required to conduct reception/transmission from/to the corresponding NR serving cells for SA (with single carrier or CA configured) except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to [7].
- is not required to conduct reception/transmission from/to the corresponding PCell, SCell(s) and E-UTRAN serving cells for NR-E-UTRA dual connectivity except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to [7].
- is not required to conduct reception/transmission from/to the corresponding NR serving cells for NR-DC except the reception of signals used for RRM measurement(s) , PRS measurement(s) and the signals used for random access procedure according to [7].

During the per-FR measurement gaps the UE:

- is not required to conduct reception/transmission from/to the corresponding E-UTRAN PCell, E-UTRAN SCell(s) and NR serving cells in the corresponding frequency range for E-UTRA-NR dual connectivity except the reception of signals used for RRM measurement(s) and the signals used for random access procedure according to TS38.321 [7].
- is not required to conduct reception/transmission from/to the corresponding NR serving cells in the corresponding frequency range for SA (with single carrier or CA configured) except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to TS38.321 [7].
- is not required to conduct reception/transmission from/to the corresponding PCell, SCell(s) and E-UTRAN serving cells in the corresponding frequency range for NR-E-UTRA dual connectivity except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to TS38.321 [7].

- is not required to conduct reception/transmission from/to the corresponding NR serving cells in the corresponding frequency range for NR-DC except the reception of signals used for RRM measurement(s), PRS measurement(s) and the signals used for random access procedure according to TS38.321 [7].

UEs shall support the measurement gap patterns listed in Table 9.1.2-1 based on the applicability specified in table 9.1.2-2 and 9.1.2-3. UE determines measurement gap timing based on gap offset configuration and measurement gap timing advance configuration provided by higher layer signalling as specified in TS 38.331 [2] and TS 36.331 [16].

Table 9.1.2-1: Gap Pattern Configurations

Gap Pattern Id	Measurement Gap Length (MGL, ms)	Measurement Gap Repetition Period (MGRP, ms)
0	6	40
1	6	80
2	3	40
3	3	80
4	6	20
5	6	160
6	4	20
7	4	40
8	4	80
9	4	160
10	3	20
11	3	160
12	5.5	20
13	5.5	40
14	5.5	80
15	5.5	160
16	3.5	20
17	3.5	40
18	3.5	80
19	3.5	160
20	1.5	20
21	1.5	40
22	1.5	80
23	1.5	160
24	10	80
25	20	160

Table 9.1.2-2: Applicability for Gap Pattern Configurations supported by the E-UTRA-NR dual connectivity UE or NR-E-UTRA dual connectivity UE

Measurement gap pattern configuration	Serving cell	Measurement Purpose[Note 5]	Applicable Gap Pattern Id
Per-UE Measurement gap	E-UTRA + FR1, or E-UTRA + FR2, or E-UTRA + FR1 + FR2	non-NR RAT [Note1,2]	0,1,2,3
		FR1 and/or FR2	0-11, 24, 25
		non-NR RAT[Note1,2] and FR1 and/or FR2	0, 1, 2, 3, 4, 6, 7, 8,10, 24, 25
Per-FR measurement gap	E-UTRA and, FR1 if configured	non-NR RAT [Note1,2]	0,1,2,3
	FR2 if configured		No gap
	E-UTRA and, FR1 if configured	FR1 only	0-11
	FR2 if configured		No gap
	E-UTRA and, FR1 if configured	FR2 only	No gap
	FR2 if configured		12-23
	E-UTRA and, FR1 if configured	non-NR RAT [Note1,2] and FR1	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		No gap
	E-UTRA and, FR1 if configured	FR1 and FR2	0-11
	FR2 if configured		12-23
	E-UTRA and, FR1 if configured	non-NR RAT [Note1,2] and FR2	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		12-23
	E-UTRA and, FR1 if configured	non-NR RAT [Note1,2] and FR1 and FR2	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		12-23

Note: In E-UTRA-NR dual connectivity mode, if GSM or UTRA TDD or UTRA FDD inter-RAT frequency layer is configured to be monitored, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap. In NR-E-UTRA dual connectivity mode, if UTRA FDD inter-RAT frequency layer is configured to be monitored for SRVCC, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap.

NOTE 1: In E-UTRA-NR dual connectivity mode, non-NR RAT includes E-UTRA, UTRA and/or GSM. In NR-E-UTRA dual connectivity mode, non-NR RAT means E-UTRA, and UTRA for SRVCC.

NOTE 2: Void

NOTE 3: When E-UTRA inter-frequency RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.

NOTE 4: For UE only supporting *supportedGapPattern-NRonly* for any gap patterns among GP2-11, the corresponding gap patterns are not applicable to any measurement in this table. For UE supporting *supportedGapPattern-NRonly-NEDC* or *measGapPatterns-NRonly-ENDC-r16* but not supporting *supportedGapPattern* for the corresponding gap patterns among GP2-11, the corresponding gap patterns are not applicable to measurement of non-NR RATs as defined in NOTE 1.

NOTE 5: Inclusion of positioning measurements: Measurement purpose which includes E-UTRA measurements includes also E-UTRA RSRP and E-UTRA RSRQ measurements for E-CID; measurement purpose which includes any of FR1 and FR2 measurements includes also RSTD, UE Rx-Tx, and PRS-RSRP measurements.

NOTE 6: Measurement gap patterns #24 and #25 can be requested [2] only when the UE is configured at least with any of RSTD, UE Rx-Tx, or PRS-RSRP measurements requiring such gaps and can only be used during the corresponding positioning measurement period

In E-UTRA-NR dual connectivity mode,

- if per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.

- if per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.
- if per-FR measurement gap for FR2 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR2 starts at time T_{MG} ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among SCG serving cells subframes in FR2.

In NR-E-UTRA dual connectivity mode,

- if per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.
- if per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms and UE has NR serving cell in FR1, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among MCG serving cells subframes in FR1.
- if per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms and UE doesn't have NR serving cell in FR1, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest E-UTRA subframe occurring immediately before the configured measurement gap among SCG serving cells subframes.
- if per-FR measurement gap for FR2 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR2 starts at time T_{MG} ms advanced to the end of the latest NR subframe occurring immediately before the configured measurement gap among MCG serving cells subframes in FR2.

In NR-NR dual connectivity mode,

- If per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest MCG subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.
- If per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest MCG subframe occurring immediately before the configured measurement gap among MCG serving cells subframes.
- If per-FR measurement gap for FR2 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR2 starts at time T_{MG} ms advanced to the end of the latest SCG subframe occurring immediately before the configured measurement gap among SCG serving cells subframes in FR2.

T_{MG} is the MG timing advance value provided in *mgta* according to TS38.331 [2].

In determining the measurement gap starting point, UE shall use the DL timing of the latest E-UTRA or NR subframe occurring immediately before the configured measurement gap among E-UTRA or NR serving cells.

For per-FR measurement gap capable UE configured with E-UTRA-NR dual connectivity or NR-E-UTRA dual connectivity, when serving cells are in E-UTRA and FR1, measurement objects are in both E-UTRA/FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN;
- If MN indicates UE that the measurement gap from MN applies to only LTE/FR1 serving cell(s),
  - UE fulfils the measurement requirements for FR1/LTE measurement objects based on the configured measurement gap pattern;
  - UE fulfils the requirements for FR2 measurement objects based on effective MGRP=20ms;

For per-FR measurement gap capable configured with E-UTRA-NR dual connectivity, NR-E-UTRA dual connectivity or NR-NR dual connectivity, when serving cells are in E-UTRA, FR1 and FR2, or in E-UTRA and FR2, or in FR1 and FR2, measurement objects are in both E-UTRA /FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN.

Table 9.1.2-3: Applicability for Gap Pattern Configurations supported by the UE with NR standalone operation (with single carrier, NR CA and NR-DC configuration)

Measurement gap pattern configuration	**Serving cell**	**Measurement Purpose [NOTE 2]**	**Applicable Gap Pattern Id**
Per-UE measurement gap	FR1 [NOTE5], or FR1 + FR2	non-NR RAT [NOTE3,6]	0,1,2,3
		FR1 and/or FR2	0-11, 24, 25
		non-NR RAT and FR1 and/or FR2 [NOTE3,6]	0, 1, 2, 3, 4, 6, 7, 8,10, 24, 25
	FR2 [NOTE5]	non-NR RAT only [NOTE3,6]	0,1,2,3
		FR1 only	0-11, 24, 25
		FR1 and FR2	0-11, 24, 25
		non-NR RAT and FR1 and/or FR2 [NOTE3,6]	0, 1, 2, 3, 4, 6, 7, 8,10, 24, 25
		FR2 only	12-23
Per-FR measurement gap	FR1 if configured	non-NR RAT only [NOTE3,6]	0,1,2,3
	FR2 if configured		No gap
	FR1 if configured	FR1 only	0-11
	FR2 if configured		No gap
	FR1 if configured	FR2 only	No gap
	FR2 if configured		12-23
	FR1 if configured	non-NR RAT and FR1 [NOTE3,6]	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		No gap
	FR1 if configured	FR1 and FR2	0-11
	FR2 if configured		12-23
	FR1 if configured	non-NR RAT and FR2 [NOTE3,6]	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		12-23
	FR1 if configured	non-NR RAT and FR1 and FR2 [NOTE3,6]	0, 1, 2, 3, 4, 6, 7, 8,10
	FR2 if configured		12-23

NOTE 1: When E-UTRA inter-RAT RSTD measurements are configured and the UE requires measurement gaps for performing such measurements, only Gap Pattern #0 can be used.

NOTE 2: Measurement purpose which includes E-UTRA measurements includes also inter-RAT E-UTRA RSRP and RSRQ measurements for E-CID; measurement purpose which includes E-UTRA measurements includes also E-UTRA RSRP and E-UTRA RSRQ measurements for E-CID; measurement purpose which includes any of FR1 or FR2 measurements includes also RSTD, UE Rx-Tx, and PRS-RSRP measurements.

NOTE 3: Void

NOTE4: If per-UE measurement gap is configured with MG timing advance of T_{MG} ms, the measurement gap starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among all serving cells subframes.
If per-FR measurement gap for FR1 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR1 starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR1.
If per-FR measurement gap for FR2 is configured with MG timing advance of T_{MG} ms, the measurement gap for FR2 starts at time T_{MG} ms advanced to the end of the latest subframe occurring immediately before the configured measurement gap among serving cells subframes in FR2.
T_{MG} is the MG timing advance value provided in *mgta* according to [2].
In determining the measurement gap starting point, UE shall use the DL timing of the latest subframe occurring immediately before the configured measurement gap among serving cells.

NOTE 5: NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.

NOTE 6: In NR single carrier, NR CA, and NR-DC mode, non-NR RAT means E-UTRA, and UTRA for SRVCC. In NR single carrier, NR CA, and NR-DC mode, if UTRA FDD inter-RAT frequency layer is configured to be monitored for SRVCC, only measurement gap pattern #0 and #1 can be used for per-FR gap in E-UTRA and FR1 if configured, or for per-UE gap.

NOTE 7: For UE only supporting *supportedGapPattern-NRonly* for any gap patterns among GP2-11, the corresponding gap patterns are not applicable to measurement of non-NR RATs as defined in NOTE 6.

NOTE 8: Measurement gap patterns #24 and #25 can be requested [2] only when the UE is configured with any of RSTD, UE Rx-Tx, or PRS-RSRP measurements requiring such gaps and can only be used during the corresponding positioning measurement period.

For per-FR measurement gap capable UE in NR standalone operation (with single carrier, NR CA and NR-DC configuration), for per-FR gap based measurement, when there is no serving cell in a particular FR, where measurement objects are configured, regardless if explicit per-FR measurement gap is configured in this FR, the effective MGRP in this FR is used to determine requirements;

- 20 ms for FR2 NR measurements
- 40 ms for FR1 NR measurements
- 40 ms for LTE measurements
- 40 ms for FR1+LTE measurements

For per-FR measurement gap capable UE in NR standalone operation (with single carrier, NR CA and NR-DC configuration), when serving cells are in FR1 or FR2, measurement objects are in both E-UTRA /FR1 and FR2,

- If MN indicates UE that the measurement gap from MN applies to E-UTRA/FR1/FR2 serving cells, UE fulfils the per-UE measurement requirements for both E-UTRA/FR1 and FR2 measurement objects based on the measurement gap pattern configured by MN;

If measurement gap is configured in one FR but measurement object is not configured in the FR, the scheduling opportunity in the FR depends on the configured measurement gap pattern.

For CA with aligned frame boundaries,

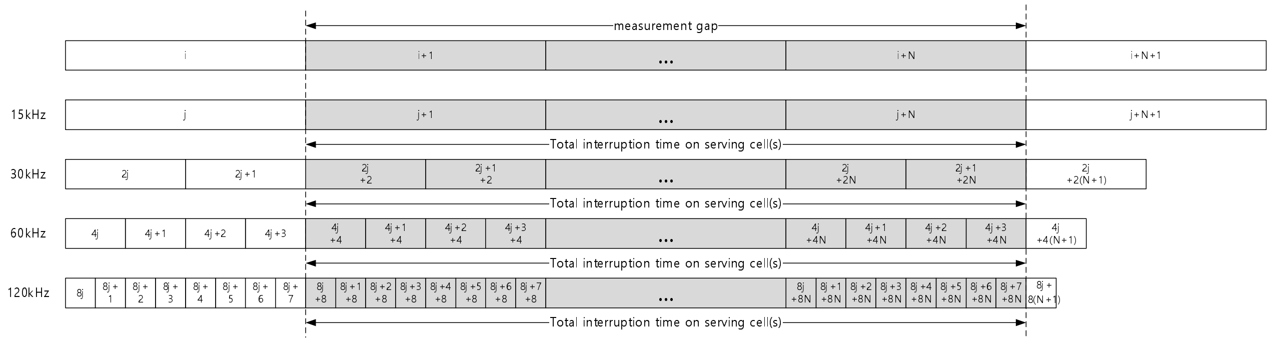
For E-UTRA-NR dual connectivity, if UE is not capable of per-FR-gap, total interruption time on SCG during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms and 3ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells in SCG during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms and 3ms, and total interruption time on FR2 serving cells in SCG during MGL is defined only when MGL(N) = 20ms, 10ms, 5.5ms, 3.5ms and 1.5ms.

For NR standalone operation (with single carrier, NR CA and NR-DC configuration), if UE is not capable of per-FR-gap, total interruption time on a serving cell during MGL is defined when MGL(N) = 20ms, 10ms, 6ms, 5.5ms, 4ms, 3.5ms, 3ms, and 1.5ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms, and 3ms, and total interruption time on FR2 serving cells during MGL is defined only when MGL(N) = 20ms, 10ms, 5.5ms, 3.5ms, and 1.5ms.

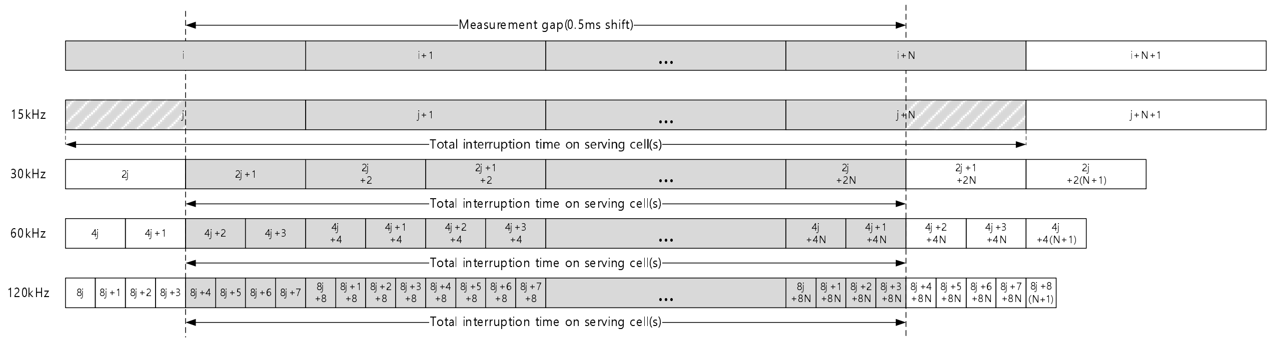
For NR-E-UTRA dual connectivity, if UE is not capable of per-FR-gap, total interruption time on MCG during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms, and 3ms. And if UE is capable of per-FR-gap, total interruption time on FR1 serving cells in MCG during MGL is defined only when MGL(N) = 20ms, 10ms, 6ms, 4ms, and 3ms, and total interruption time on FR2 serving cells in MCG during MGL is defined only when MGL(N) = 20ms, 10ms, 5.5ms, 3.5ms, and 1.5ms.

For CA with non-aligned frame boundaries,

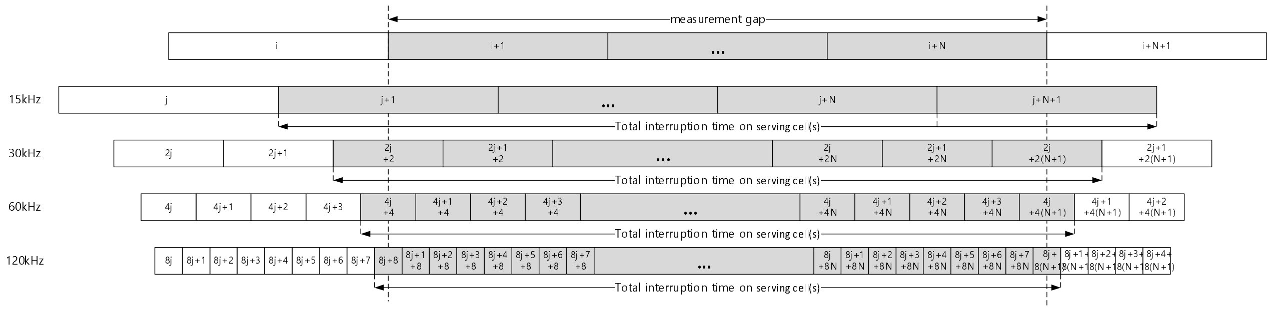
- The total interruption time on an SCC is the same as the case CA with aligned frame boundaries, if no SCC slots are partially overlapped with the measurement gap.
- The total interruption time on an SCC will be additionally extended by one SCC slot, if there exist SCC slots partially overlapped with the measurement gap.



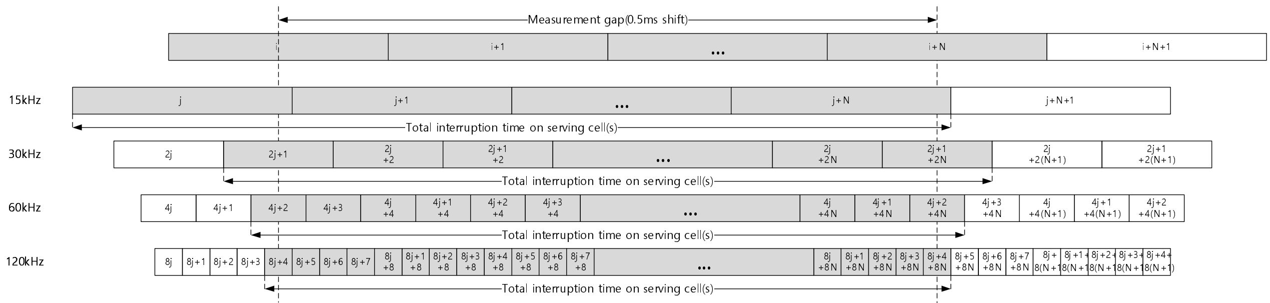
(a) Measurement gap with MGL = N(ms) with MG timing advance of 0ms for all serving cells in synchronous EN-DC, NR standalone operation (with single carrier, NR CA and synchronous NR-DC configuration) and synchronous NE-DC, and for serving cells in MCG in NR standalone operation (with asynchronous NR-DC configuration)



(b) Measurement gap with MGL = N(ms) with MG timing advance of 0.5ms for all serving cells in synchronous EN-DC, NR standalone operation (with single carrier, NR CA and synchronous NR-DC configuration) and synchronous NE-DC, and for serving cells in MCG in NR standalone operation (with asynchronous NR-DC configuration)



(c) Measurement gap with MGL = N(ms) with MG timing advance of 0ms for all serving cells in asynchronous EN-DC and asynchronous NE-DC, and for serving cells in SCG in NR standalone operation (with asynchronous NR-DC configuration)



(d) Measurement gap with MGL = N(ms) with MG timing advance of 0.5ms for all serving cells in asynchronous EN-DC and asynchronous NE-DC, and for serving cells in SCG in NR standalone operation (with asynchronous NR-DC configuration)

Figure 9.1.2-1: Measurement GAP and total interruption time on serving cells for EN-DC, NR standalone operation (with single carrier, NR CA and NR-DC configuration) and NE-DC

The corresponding total number of interrupted slots on serving cells is listed in Table 9.1.2-4 for all serving cells in synchronous EN-DC, NR standalone (with single carrier, NR CA and synchronous NR-DC configuration) and NE-DC, and for serving cells in MCG in NR standalone operation (with asynchronous NR-DC configuration). The corresponding total number of interrupted slots on serving cells is listed in Table 9.1.2-4a for asynchronous EN-DC, and for serving cells in SCG in NR standalone operation (with asynchronous NR-DC configuration).

Table 9.1.2-4: Total number of interrupted slots on all serving cells during MGL for Synchronous EN-DC, NR standalone operation (with single carrier, NR CA and synchronous NR-DC configuration) and NE-DC, and on all serving cells in MCG for NR standalone operation (with asynchronous NR-DC configuration) with per-UE measurement gap or per-FR measurement gap for FR1

NR SCS (kHz)	Total number of interrupted slots on serving cells									
	When MG timing advance of 0ms is applied					When MG timing advance of 0.5ms is applied				
	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms
15	20	10	6	4	3	21 Note3	11 Note3	7 Note3	5 Note3	4 Note3
30	40	20	12	8	6	40	20	12	8	6
60	80	40	24	16	12	80	40	24	16	12
120	160	80	48	32	24	160	80	48	32	24
NOTE 1: For Gap Pattern ID 0, 1, 2 and 3, total number of interrupted subframes on MCG is MGL subframes when MG timing advance of 0ms is applied, and (MGL+1) subframes when MG timing advance of 0.5ms is applied. NOTE 2: NR SCS of 120 kHz is only applicable to the case with per-UE measurement gap. NOTE 3: Non-overlapped half-slots occur before and after the measurement gap. Whether a Rel-15 UE can receive and/or transmit in those half-slots is up to UE implementation.										

Table 9.1.2-4a: Total number of interrupted slots on serving cells during MGL for Asynchronous EN-DC, and on all serving cells in SCG for NR standalone operation (with asynchronous NR-DC configuration) with per-UE measurement gap or per-FR measurement gap for FR1

NR SCS (kHz)	Total number of interrupted slots on serving cells									
	When MG timing advance of 0ms is applied					When MG timing advance of 0.5ms is applied				
	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms	MGL=20 ms	MGL=10 ms	MGL=6 ms	MGL=4 ms	MGL=3 ms
15	21	11	7	5	4	21	11	7	5	4
30	41	21	13	9	7	41	21	13	9	7
60	81	41	25	17	13	81	41	25	17	13
120	161	81	49	33	25	161	81	49	33	25
NOTE 1: For Gap Pattern ID 0, 1, 2 and 3, total number of interrupted subframes on MCG is MGL subframes when MG timing advance of 0ms is applied, and (MGL+1) subframes when MG timing advance of 0.5ms is applied. NOTE 2: NR SCS of 120 kHz is only applicable to the case with per-UE measurement gap.										

In case that UE capable of per-FR measurement gap is configured with per-FR measurement gap for FR2 serving cells, total number of interrupted slots on FR2 serving cells during MGL is listed in Table9.1.2-4b.

Table 9.1.2-4b: Total number of interrupted slots on FR2 serving cells during MGL for EN-DC, NR standalone operation (with single carrier, NR CA and NR-DC configuration) and NE-DC with per-UE measurement gap or per-FR measurement gap for FR2

NR SCS (kHz)	Total number of interrupted slots on FR2 serving cells									
	When MG timing advance of 0ms is applied					When MG timing advance of 0.25ms is applied				
	MGL= 20ms	MGL= 10ms	MGL= 5.5ms	MGL= 3.5ms	MGL= 1.5ms	MGL= 20ms	MGL= 10ms	MGL= 5.5ms	MGL= 3.5ms	MGL= 1.5ms
60	80	40	22	14	6	80	40	22	14	6
120	160	80	44	28	12	160	80	44	28	12
NOTE 1: The total number of interrupted slots is based on that SFN and subframe reference for per-FR gap in FR2 indicated by high layer parameter *refServCellIndicator* is an FR2 serving cell. NOTE 2: Slot occurs before or after the measurement gap may be interrupted additionally if SFN and subframe reference for per-FR gap in FR2 indicated by high layer parameter refServCellIndicator is an FR1 serving cell.										

It is up to UE implementation whether or not the UE is able to conduct transmission in the following slot(s),

- when MGTA is not applied, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap
- when MGTA is applied and the SCS of the UL carrier is other than 15kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after measurement gap
- when MGTA is applied and the SCS of the UL carrier is 15kHz, in the L consecutive UL slots with respect to the SCS of the UL carrier with the same slot indices as the DL slots occurring immediately after the slot partially overlapped with measurement gap

where UL slot denotes that all the symbols in the slot are uplink symbols, and L=1 if $(N_{\text{TA}} + N_{\text{TA offset}}) \times T_{\text{c}}$ for the UL transmission is less than the length of one slot; L=2 otherwise.

Note: Network is supposed to take into account the possible difference between the estimated TA at network and actual TA at UE when scheduling UE in the above slot(s).

Table 9.1.2-5: (Void)

9.1.2.1 EN-DC: Measurement Gap Sharing

For E-UTRA-NR dual connectivity UE configured with per-UE measurement gap, measurement gap sharing shall be applies when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers or when SMTC configured for inter-frequency measurement are fully overlapping with per-UE measurement gaps, E-UTRA gap-needed inter-frequency carriers and inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

For E-UTRA-NR dual connectivity UE configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR1 inter-frequency carriers or when SMTC configured for inter-frequency measurement are fully overlapping with per-UE measurement gaps, E-UTRA gap-needed inter-frequency carriers, inter-RAT UTRAN carriers and/or inter-RAT GSM carriers.

For E-UTRA-NR dual connectivity UE configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR2 inter-frequency carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-UE measurement gaps.

When network signals “01”, “10” or “11” with RRC parameter *MeasGapSharingScheme* [2][16]and the value of X is defined as in Table 9.1.2.1-1, and

- K_{intra} = 1 / X * 100,
- K_{inter} = 1 / (100 – X) * 100,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2.1.

Table 9.1.2.1-1: Value of parameter X for EN-DC measurement gap sharing

measGapSharingScheme	**Value of X (%)**
‘00’	Equal splitting
‘01’	25
‘10’	50
‘11’	75
Note: It is left to UE implementation to determine which measurement gap sharing scheme in the table *to be applied*, when *MeasGapSharingScheme is absent and there is* no stored value in the field.	

9.1.2.1a SA: Measurement Gap Sharing

For NR standalone UE without NR-DC operation and configured with per-UE measurement gap, measurement gap sharing shall be applies when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-UE measurement gaps, and/or inter-RAT E-UTRAN carriers, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers.

For NR standalone UE without NR-DC operation and configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR1 inter-frequency carriers and/or inter-RAT E-UTRAN carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-FR1 measurement gaps, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers in FR1.

For NR standalone UE without NR-DC operation and configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR2 inter-frequency carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE is configured to measure positioning frequency layers in FR2.

When network signals “01”, “10” or “11” with RRC parameter *MeasGapSharingScheme* [2] and the value of X is defined as in Table 9.1.2.1a-1, and

- K_{intra} = 1 / X * 100,
- K_{inter} = 1 / (100 – X) * 100,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2.2.

Table 9.1.2.1a-1: Value of parameter X for NR standalone measurement gap sharing

measGapSharingScheme	Value of X (%)
'00'	Equal splitting
'01'	25
'10'	50
'11'	75
Note: It is left to UE implementation to determine which measurement gap sharing scheme in the table *to be applied*, when *MeasGapSharingScheme is absent and there is* no stored value in the field.	

9.1.2.1b NE-DC: Measurement Gap Sharing

For NR-E-UTRA dual connectivity UE configured with per-UE measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers, E-UTRA gap-needed inter-frequency carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-UE measurement gaps, and/or inter-RAT E-UTRA carriers, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers.

For NR-E-UTRA dual connectivity UE configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-FR1 measurement gaps, E-UTRA gap-needed inter-frequency carriers, and/or inter-RAT E-UTRA carriers, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers in FR1.

For NR-E-UTRA dual connectivity UE configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR2 inter-frequency carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE is configured to measure positioning frequency layers in FR2.

When network signals "01", "10" or "11" with RRC parameter *measGapSharingConfig* [2][16] and the value of X is defined as in Table 9.1.2.1b-1, and

- $K_{intra} = 1 / X * 100$,
- $K_{inter} = 1 / (100 – X) * 100$,

When network signals "00" indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2.3.

Table 9.1.2.1b-1: Value of parameter X for NE-DC measurement gap sharing

measGapSharingScheme	Value of X (%)
'00'	Equal splitting
'01'	25
'10'	50
'11'	75
Note: It is left to UE implementation to determine which measurement gap sharing scheme in the table *to be applied*, when *MeasGapSharingScheme is absent and there is* no stored value in the field.	

9.1.2.1c NR-DC: Measurement Gap Sharing

For UE with NR-DC operation and configured with per-UE measurement gap, measurement gap sharing shall be applies when UE requires measurement gaps to identify and measure cells on intra-frequency carriers or when SMTC configured for intra-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE requires measurement gaps to identify and measure cells on inter-frequency carriers, and/or inter-RAT E-UTRAN carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-UE measurement gaps, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers.

For UE with NR-DC operation and configured with per-FR1 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR1 intra-frequency carriers or when SMTC configured for FR1 intra-frequency measurement are fully overlapping with per-FR1 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR1 inter-frequency carriers and/or inter-RAT E-UTRAN carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-FR1 measurement gaps, and/or inter-RAT UTRAN carriers for SRVCC, and when UE is configured to measure positioning frequency layers in FR1.

For UE with NR-DC operation and configured with per-FR2 measurement gap, measurement gap sharing shall be applied when UE requires measurement gaps to identify and measure cells on FR2 intra-frequency carriers or when SMTC configured for FR2 intra-frequency measurement are fully overlapping with per-FR2 measurement gaps, and when UE requires measurement gaps to identify and measure cells on FR2 inter-frequency carriers, or when SMTC configured for inter-frequency measurement are fully overlapping with per-UE measurement gaps, and when UE is configured to measure positioning frequency layers in FR2.

When network signals “01”, “10” or “11” with RRC parameter *measGapSharingConfig* [2] and the value of X is defined as in Table 9.1.2.1c-1, and

- $K_{intra} = 1 / X * 100$,
- $K_{inter} = 1 / (100 – X) * 100$,

When network signals “00” indicating equal splitting gap sharing, X is not applied.

The RRC parameter *MeasGapSharingScheme* shall be applied to the calculation of carrier specific scaling factor as specified in clause 9.1.5.2..4.

Table 9.1.2.1c-1: Value of parameter X for NR-DC measurement gap sharing

measGapSharingConfig	**Value of X (%)**
‘00’	Equal splitting
‘01’	25
‘10’	50
‘11’	75
Note: It is left to UE implementation to determine which measurement gap sharing scheme in the table *to be applied*, when *MeasGapSharingScheme is absent and there is* no stored value in the field.	

9.1.3 UE Measurement capability

9.1.3.1 EN-DC: Monitoring of multiple layers using gaps

The requirements in this clause are applicable for UE capable of and configured with the EN-DC operation mode.

When monitoring of multiple inter-frequency E-UTRAN, inter-RAT NR, GSM, UTRA FDD and UTRA TDD carriers as configured by E-UTRA PCell, and inter-frequency NR carriers (with or without CCA) as configured by PSCell using gaps (or without using gaps provided the UE supports such capability) is configured, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR, SFTD, E-UTRAN RSRP, E-UTRAN RSRQ, E-UTRAN RS-SINR measurements, UTRAN TDD P-CCPCH RSCP, UTRAN FDD CPICH measurements, GSM carrier RSSI, etc.) of detected cells on all the layers.

For UE configured with the EN-DC operation, the effective total number of frequencies excluding the frequencies of the PSCell, SCells, E-UTRA PCell, and E-UTRA SCells being monitored is $N_{freq,\ EN\text{-}DC}$, which is defined as:

$$N_{freq,\ EN\text{-}DC} = N_{freq,\ EN\text{-}DC,\ NR} + N_{freq,\ EN\text{-}DC,\ E\text{-}UTRA} + N_{freq,\ EN\text{-}DC,\ UTRA} + M_{EN\text{-}DC,\ GSM},$$

where

$N_{freq,\ EN\text{-}DC,\ E\text{-}UTRA}$ is the number of E-UTRA inter-frequency carriers being monitored (FDD and TDD) as configured by E-UTRA PCell or via LPP [22],

$N_{freq,\ EN\text{-}DC,\ NR} \leqslant N_{freq,\ EN\text{-}DC,\ NR,\ inter\text{-}RAT} + N_{freq,\ EN\text{-}DC,\ NR,\ inter\text{-}freq}$

where

$N_{freq,\ EN\text{-}DC,\ NR,\ inter\text{-}RAT}$ is the number of NR inter-RAT carriers excluding NR serving carrier(s) being monitored as configured by E-UTRA PCell [15],

$N_{freq,\ EN\text{-}DC,\ NR,\ inter\text{-}freq}$ is the number of NR inter-frequency carriers being monitored as configured by PSCell,

$N_{freq,\ EN\text{-}DC,\ UTRA}$ is the number of UTRA inter-RAT carriers being monitored as configured by E-UTRA PCell (FDD and TDD).

$M_{EN\text{-}DC,\ GSM}$ is an integer which is a function of the number of GSM inter-RAT carriers as configured by E-UTRA PCell on which measurements are being performed. $M_{EN\text{-}DC,\ GSM}$ is equal to 0 if no GSM carrier is being monitored. For a MGRP of 40 ms, $M_{EN\text{-}DC,\ GSM}$ is equal to 1 if cells on up to 32 GSM carriers are being measured. For a MGRP of 80 ms, $M_{EN\text{-}DC,\ GSM}$ is equal to ceil($N_{carriers,GSM}$ /20) where $N_{carriers,GSM}$ is the number of GSM carriers on which cells are being measured.

9.1.3.1a SA: Monitoring of multiple layers using gaps

The requirements in this clause are applicable for UE configured with SA NR operation mode.

When monitoring of multiple inter-RAT E-UTRAN carriers, inter-frequency NR carriers (with or without CCA) and inter-RAT UTRA FDD carriers using gaps (or without using gaps provided the UE supports such capability) is configured by PCell, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR, E-UTRAN RSRP, E-UTRAN RSRQ, E-UTRAN RS-SINR measurements, UTRAN FDD CPICH measurement, etc.) of detected cells on all the layers.

For UE configured with the NR SA operation, the effective total number of frequencies, excluding the frequencies of the PCell, PSCell and SCells being monitored, is $N_{freq,\ SA}$, which is defined as:

$$N_{freq,\ SA} = N_{freq,\ SA,\ NR} + N_{freq,\ SA,\ E\text{-}UTRA} + N_{freq,\ SA,\ UTRA},$$

where

$N_{freq,\ SA,\ E\text{-}UTRA}$ is the number of E-UTRA inter-RAT carriers being monitored (FDD and TDD) as configured by PCell or via LPP [22],

- $N_{freq,\ SA,\ UTRA}$ is the number of UTRA FDD inter-RAT carriers being monitored as configured by PCell,

$N_{freq,\ SA,\ NR}$ is the number of NR inter-frequency carriers being monitored as configured by PCell.

9.1.3.1b NE-DC: Monitoring of multiple layers using gaps

The requirements in this clause are applicable for UE capable of and configured with the NE-DC operation mode.

When monitoring of multiple inter-frequency E-UTRAN carriers as configured by E-UTRA PSCell, inter-RAT E-UTRAN carriers as configured by PCell, inter-RAT UTRA FDD carriers as configured by PCell, and inter-frequency NR carriers as configured by PCell using gaps (or without using gaps provided the UE supports such capability) is configured, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR, SFTD, E-UTRAN RSRP, E-UTRAN RSRQ, and E-UTRAN RS-SINR measurements, UTRAN FDD CPICH measurements, etc.) of detected cells on all the layers.

For UE configured with the NE-DC operation, the effective total number of frequencies excluding the frequencies of the PCell, SCells, E-UTRA PSCell, and E-UTRA SCells being monitored is $N_{freq,\ NE\text{-}DC}$, which is defined as:

$$N_{freq,\ NE\text{-}DC} = N_{freq,\ NE\text{-}DC,\ NR} + N_{freq,\ NE\text{-}DC,\ E\text{-}UTRA} + N_{freq,\ NE\text{-}DC,\ UTRA},$$

where

$N_{freq,\ NE\text{-}DC,\ NR}$ is the number of NR inter-frequency carriers being monitored as configured by PCell,

$N_{freq,\ NE\text{-}DC,\ UTRA}$ is the number of UTRA FDD inter-RAT carriers being monitored as configured by PCell,

$N_{freq,\ NE\text{-}DC,\ E\text{-}UTRA} \leqslant N_{freq,\ NE\text{-}DC,\ E\text{-}UTRA,\ inter\text{-}RAT} + N_{freq,\ NE\text{-}DC,\ E\text{-}UTRA,\ inter\text{-}freq}$

where

$N_{freq,\ NE\text{-}DC,\ E\text{-}UTRA,\ inter\text{-}RAT}$ is the number of E-UTRA inter-RAT carriers (FDD and TDD) excluding E-UTRA serving carrier(s) being monitored as configured by PCell or via LPP [22],

$N_{freq,\ NE\text{-}DC,\ E\text{-}UTRA,\ inter\text{-}freq}$ is the number of E-UTRA inter-frequency carriers (FDD and TDD) being monitored as configured by E-UTRA PSCell [15] or via LPP [22].

9.1.3.1c NR-DC: Monitoring of multiple layers using gaps

The requirements in this clause are applicable for UE configured with NR-DC operation mode.

When monitoring of multiple inter-RAT E-UTRAN carriers and inter-frequency NR carriers using gaps (or without using gaps provided the UE supports such capability) as configured by PCell, inter-RAT UTRA FDD carriers as configured by PCell, and inter-frequency NR carriers as configured by PSCell is configured, the UE shall be capable of performing one measurement of the configured measurement type (SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, CSI-SINR, E-UTRAN RSRP, E-UTRAN RSRQ, E-UTRAN RS-SINR measurements, UTRAN FDD CPICH measurements, etc.) of detected cells on all the layers.

For UE configured with the NR-DC operation, the effective total number of frequencies, excluding the frequencies of the PCell, PSCell and SCells being monitored, is $N_{freq,\ NR\text{-}DC}$, which is defined as:

$$N_{freq,\ NR\text{-}DC} = N_{freq,\ NR\text{-}DC,\ NR} + N_{freq,\ NR\text{-}DC,\ E\text{-}UTRA} + N_{freq,\ NR\text{-}DC,\ UTRA},$$

where

- $N_{freq,\ NR\text{-}DC,\ E\text{-}UTRA}$ is the number of E-UTRA inter-RAT carriers being monitored (FDD and TDD) as configured by PCell or via LPP [22].
- $N_{freq,\ NE\text{-}DC,\ UTRA}$ is the number of UTRA FDD inter-RAT carriers being monitored as configured by PCell,
- $N_{freq,\ NR\text{-}DC,\ NR}$ is the number of NR inter-frequency carriers being monitored as configured by PCell and PSCell.

9.1.3.2 EN-DC: Maximum allowed layers for multiple monitoring

If a UE is configured with EN-DC operation, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PSCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PSCell, and
- Depending on UE capability, 7 NR SSB inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell [15], and
- Depending on UE capability, 6 E-UTRA TDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 6 E-UTRA FDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 3 FDD UTRA carriers, and
- Depending on UE capability, 3 TDD UTRA carriers, and

- Depending on UE capability, 32 GSM carriers (one GSM layer corresponds to 32 carriers), and
- Depending on UE capability, 1 E-UTRA FDD inter-frequency carrier for RSTD measurements configured via LPP [22], and
- Depending on UE capability, 1 E-UTRA TDD inter-frequency carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD and GSM (one GSM layer corresponds to 32 carriers) layers. The UE shall be capable of monitoring a total of at least 7 + N_{CSI} effective NR carrier frequency layers excluding NR serving carrier(s), comprising of any above defined combination of NR inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell and NR inter-frequency carriers configured by PSCell, N_{CSI} equals 1 if UE supports CSI-RS based L3 measurement, and N_{CSI} =0 otherwise.

The number of SSB frequency layers equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or
- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency*, *smtc1*, *smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

When the E-UTRA PCell and PSCell configures the same NR carrier frequency layer to be monitored by the UE in synchronous intra-band EN-DC, this layer shall be counted only once to the total number of effective carrier frequency layers provided that the SFN-s and slot boundaries are aligned, unless the configured NR carrier frequency layers to be monitored have

- different RSSI measurement resources or
- different *deriveSSB-IndexFromCell* indications or
- different SMTC configurations or
- different *ssb-PositionQCL-Common-r16* indications or cell list of *ssb-PositionQCL* on NR carrier frequency layer with CCA or
- different *rmtc-Config-r16* indication on NR carrier frequency layer with CCA.

Note 1: The E-UTRA-NR dual connectivity capable UE configured with PSCell shall fulfil the requirements defined in only one of clause 9.1.3.2 and clause 8.1.2.1.1b.1 of TS 36.133 [15].

9.1.3.2a SA: Maximum allowed layers for multiple monitoring

If a UE is configured with SA NR operation mode, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PCell, and
- Depending on UE capability, 7 E-UTRA TDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA FDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 3 UTRA FDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 1 E-UTRA FDD inter-RAT carrier for RSTD measurements configured via LPP [22], and

- Depending on UE capability, 1 E-UTRA TDD inter-RAT carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least [13] effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD and UTRA FDD layers.

The number of SSB frequency layers equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or

- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency, smtc1, smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

9.1.3.2b NE-DC: Maximum allowed layers for multiple monitoring

If a UE is configured with NE-DC operation mode, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PCell, and

- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PCell, and

- Depending on UE capability, 6 E-UTRA TDD inter-RAT carriers excluding E-UTRA serving carriers configured by PCell, and

- Depending on UE capability, 6 E-UTRA FDD inter-RAT carriers excluding E-UTRA serving carriers configured by PCell, and

- Depending on UE capability, 6 E-UTRA TDD inter-frequency carriers configured by E-UTRA PSCell [15], and

- Depending on UE capability, 6 E-UTRA FDD inter-frequency carriers configured by E-UTRA PSCell [15], and

- Depending on UE capability, 3 UTRA FDD inter-RAT carriers configured by PCell, and

- Depending on UE capability, 1 E-UTRA FDD inter-frequency carrier for RSTD measurements configured via LPP [22], and

- Depending on UE capability, 1 E-UTRA TDD inter-frequency carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD and UTRA FDD layers. The UE shall be capable of monitoring a total of at least 6 effective E-UTRA carrier frequency layers, excluding E-UTRA serving carrier(s), comprising of any above defined combination of E-UTRA inter-RAT carriers excluding E-UTRA serving carrier(s) configured by PCell and E-UTRA inter-frequency carriers configured by E-UTRA PSCell.

The number of SSB frequency layers equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or

- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency, smtc1, smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

9.1.3.2c NR-DC: Maximum allowed layers for multiple monitoring

If a UE is configured with NR-DC operation, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PCell, and
- Depending on UE capability, 7 NR SSB inter-frequency carriers configured by PSCell, and
- Depending on UE capability, 8 NR inter-frequency carriers including SSB and CSI-RS in total configured by PSCell, and
- Depending on UE capability, 7 E-UTRA TDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA FDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 3 UTRA FDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 1 E-UTRA FDD inter-RAT carrier for RSTD measurements configured via LPP [22], and
- Depending on UE capability, 1 E-UTRA TDD inter-RAT carrier for RSTD measurements configured via LPP [22].

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD and UTRA FDD layers. The UE shall be capable of monitoring a total of at least 7 + N_{CSI} effective NR carrier frequency layers excluding NR serving carrier(s), which are configured by PCell and PSCell, N_{CSI} equals 1 if UE supports CSI-RS based L3 measurement, and N_{CSI} =0 otherwise.

The number of SSB frequency layers equals to the total number of MOs with

- *ssb-ConfigMobility* configured, or
- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency*, *smtc1*, *smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

The number of CSI-RS frequency layers equals to the number of MOs with *csi-rs-ResourceConfigMobility* configured assuming single MO is configured per frequency layer.

When PCell and PSCell configures the same NR carrier frequency layer to be monitored by the UE in NR-DC, this layer shall be counted only once to the total number of effective carrier frequency layers provided that the SFN-s and slot boundaries are aligned, unless the configured NR carrier frequency layers to be monitored have

- different RSSI measurement resources or
- different *deriveSSB-IndexFromCell* indications or
- different SMTC configurations or
- different *ssb-PositionQCL-Common-r16* indications or cell list of *ssb-PositionQCL* on NR carrier frequency layer with CCA or
- different *rmtc-Config-r16* indication on NR carrier frequency layer with CCA.

9.1A.3.2 Void

9.1.3A UE Measurement capability under operation mode with CCA

9.1.3A.1 EN-DC: Monitoring of multiple layers using gaps under CCA

The requirements in clause 9.1.3.1 are also applicable for the UE capable of and configured with the EN-DC operation mode with CCA on PSCC.

9.1.3A.1A SA: Monitoring of multiple layers using gaps under CCA

The requirements in clause 9.1.3.1a are also applicable for UE configured with SA NR operation mode with CCA on PCC.

9.1.3A.2 EN-DC: Maximum allowed layers for multiple monitoring under CCA

If a UE is configured with EN-DC operation when CCA is used on PSCell, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR inter-frequency carriers configured by PScell, and
- Depending on UE capability, 7 NR inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell [15], and
- Depending on UE capability, 6 E-UTRA TDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 6 E-UTRA FDD inter-frequency carriers configured by E-UTRA PCell [15], and
- Depending on UE capability, 3 FDD UTRA carriers, and
- Depending on UE capability, 3 TDD UTRA carriers, and
- Depending on UE capability, 32 GSM carriers (one GSM layer corresponds to 32 carriers), and

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least 13 effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD, E-UTRA TDD, UTRA FDD, UTRA TDD and GSM (one GSM layer corresponds to 32 carriers) layers. The UE shall be capable of monitoring a total of at least 7 effective NR carrier frequency layers excluding NR serving carrier(s), comprising of any above defined combination of NR inter-RAT carriers excluding NR serving carrier(s) configured by E-UTRA PCell and NR inter-frequency carriers configured by PSCell.

When the E-UTRA PCell and PSCell configures the same NR carrier frequency layer to be monitored by the UE in synchronous intra-band EN-DC, this layer shall be counted only once to the total number of effective carrier frequency layers provided that the SFN-s and slot boundaries are aligned, unless the configured NR carrier frequency layers to be monitored have

- different RSSI measurement resources or
- different *deriveSSB-IndexFromCell* indications or
- different SMTC configurations or
- different *ssb-PositionQCL-Common-r16* indications or cell list of *ssb-PositionQCL* on NR carrier frequency layer with CCA or
- different *rmtc-Config-r16* indication on NR carrier frequency layer with CCA.

9.1A.3.2a Void9.1.3A.2A SA: Maximum allowed layers for multiple monitoring under CCA

If a UE is configured with SA NR operation mode when CCA is used on PCell or SCell only, the UE shall be capable of monitoring at least:

- Depending on UE capability, 7 NR inter-frequency carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA TDD inter-RAT carriers configured by PCell, and
- Depending on UE capability, 7 E-UTRA FDD inter-RAT carriers configured by PCell, and

In addition to the requirements defined above, the UE shall be capable of monitoring a total of at least [13] effective carrier frequency layers comprising of any above defined combination of NR, E-UTRA FDD and E-UTRA TDD layers.

9.1.4 Capabilities for Support of Event Triggering and Reporting Criteria

9.1.4.1 Introduction

This clause contains requirements on UE capabilities for support of event triggering and reporting criteria. As long as the measurement configuration does not exceed the requirements stated in clause 9.1.4.2, the UE shall meet all other performance requirements defined in clause 9 and clause 10. The requirements in this clause also apply for a UE in EN-DC with PSCell on a carrier frequency with CCA or SA NR with PCell on a carrier frequency with CCA.

The UE can be requested to make measurements under different measurement identities defined in TS 38.331 [2]. Each measurement identity corresponds to either event-based reporting, periodic reporting, or no reporting. In case of event-based reporting, each measurement identity is associated with an event triggering criterion. In case of periodic reporting, a measurement identity is associated with one periodic reporting criterion. In case of no reporting, a measurement identity is associated with one no reporting criterion.

The purpose of this clause is to set some limits on the number of different event triggering, periodic, and no reporting criteria the UE may be requested to track in parallel.

9.1.4.2 Requirements

In this clause a reporting criterion corresponds to either one event (in the case of event-based reporting), or one periodic reporting criterion (in case of periodic reporting), or one no reporting criterion (in case of no reporting). For event-based reporting, each instance of event, with the same or different event identities, is counted as separate reporting criterion in Table 9.1.4.2-1.

The UE shall be able to support in parallel per category up to E_{cat} reporting criteria according to Table 9.1.4.2-1. For the measurement categories belonging to intra-frequency, inter-frequency, and inter-RAT measurements (i.e. without counting other categories that the UE shall always support in parallel), the UE need not support more than the total number of reporting criteria as follows:

- For UE configured with EN-DC: $E_{cat,EN-DC,NR} + E_{cat,EN-DC,E-UTRA}$, where

  $E_{cat,EN-DC,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria configured by PSCell (NR intra- and inter-frequency reporting criteria) and by E-UTRA PCell on NR serving frequencies (NR intra-frequency reporting criteria) applicable for UE configured with EN-DC according to Table 9.1.4.2-1, and n is the number of configured NR serving frequencies, including PSCell and SCells carrier frequencies,

  $E_{cat,EN-DC,E-UTRA}$ is the total number of reporting criteria configured by E-UTRA PCell except PSCell and SCells carrier frequencies, as specified in TS 36.133 [15] for UE configured with EN-DC.

- For UE configured with NE-DC: $E_{cat,NE-DC,NR} + E_{cat,NE-DC,E-UTRA}$, where

  $E_{cat,NE-DC,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria according to Table 9.1.4.2-1, and n is the number of configured NR serving frequencies, including PCell and SCells carrier frequencies,

  $E_{cat,NE-DC,E-UTRA} = E_{cat,NE-DC,E-UTRA,inter-RAT} + E_{cat,NE-DC,E-UTRA,intra-RAT}$, where

  $E_{cat,NE-DC,E-UTRA,inter-RAT}$ is the total number of inter-RAT E-UTRA reporting criteria configured by PCell except E-UTRA PSCell and E-UTRA SCells carrier frequencies, according to Table 9.1.4.2-1,

  $E_{cat,NE-DC,E-UTRA,intra-RAT}$ is the total number of E-UTRA reporting criteria including E-UTRA PSCell and E-UTRA SCells carrier frequencies as specified in TS 36.133 [15] for UE configured with NE-DC.

- For UE configured with SA operation mode: $E_{cat,SA,NR} + E_{cat,SA,E-UTRA}$, where

  $E_{cat,SA,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria according to Table 9.1.4.2-1, and n is the number of configured NR serving frequencies, including PCell, and SCells carrier frequencies,

  $E_{cat,SA,E-UTRA}$ is the total number of inter-RAT E-UTRA reporting criteria according to Table 9.1.4.2-1.

- For UE configured with NR-DC: $E_{cat,NR-DC,NR} + E_{cat,NR-DC,E-UTRA}$, where

  $E_{cat,NR-DC,NR} = 10 + 9 \times n$ is the total number of NR reporting criteria according to Table 9.1.4.2-1, and n is the number of configured NR serving frequencies, including PCell, PSCell and SCells carrier frequencies,

  $E_{cat,NR-DC,E-UTRA}$ is the total number of inter-RAT E-UTRA reporting criteria according to Table 9.1.4.2-1.

Table 9.1.4.2-1: Requirements for reporting criteria per measurement category

Measurement category	E_{cat}	Note
Intra-frequency Note 1,2,3,4,5	9	Events for any one or a combination of intra-frequency SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, and CSI-SINR for NG-RAN intra-frequency cells
Inter-frequency Note 2,3,4,5	10	Events for any one or a combination of inter-frequency SS-RSRP, SS-RSRQ, SS-SINR, CSI-RSRP, CSI-RSRQ, and CSI-SINR for NG-RAN inter-frequency cells
Inter-RAT (E-UTRA FDD, E-UTRA TDD) Note 2,4,5	10	Only applicable for UE with this (inter-RAT) capability. These reporting criteria apply for any E-UTRA carrier frequencies other than the carrier frequency of the E-UTRA PSCell or E-UTRA SCell.
Inter-RAT (E-UTRA FDD, E-UTRA TDD) RSTD Note 2,4,5	1	Inter-RAT RSTD measurement reporting for UE supporting OTDOA; 1 report capable of minimum 16 inter-RAT cell measurements. Only applicable for UE with this (inter-RAT RSTD via LPP [22]) capability. These reporting criteria apply for any E-UTRA carrier frequencies other than the carrier frequency of the E-UTRA PSCell or E-UTRA SCell.
Inter-RAT (E-UTRA FDD, E-UTRA TDD) RSRP and RSRQ measurements for E-CID Note 2,4,5	1	Inter-RAT RSRP and RSRQ measurements for E-CID reported to E-SMLC via LPP [22]. One report capable of at least in total 10 inter-RAT RSRP and RSRQ measurements. Applicable to UE capable of reporting inter-RAT RSRP and RSRQ to E-SMLC via LPP. These reporting criteria apply for any E-UTRA carrier frequencies other than the carrier frequency of the E-UTRA PSCell or E-UTRA SCell.
Intra-frequency RSSI and channel occupancy measurements with CCA Note 1,2,3	1	One report capable of one RSSI and one channel occupancy measurements over a channel [TS 37.213] with CCA. Applicable for UE capable of performing and reporting RSSI and channel occupancy on carrier frequencies under CCA.
Inter-frequency RSSI and channel occupancy measurements with CCA Note 2,3	1	One report capable of one RSSI and one channel occupancy measurements over a channel [TS 37.213] with CCA. Applicable for UE capable of performing and reporting RSSI and channel occupancy on carrier frequencies under CCA.
Intra-frequency SSB-based measurements for NR E-CID Note 1,2,3,4,5	1	Intra-frequency SS-RSRP and SS-RSRQ measurements for NR E-CID reported to LMF via LPP [34]. One report capable of at least in total 9 intra-frequency SS-RSRP and SS-RSRQ measurements. Applicable to UE capable of reporting at least one of SS-RSRP and SS-RSRQ to LMF via LPP.
Intra-frequency CSI-RS based measurements for NR E-CID Note 1,2,3,4,5	1	Intra-frequency CSI-RSRP and CSI-RSRQ measurements for NR E-CID reported to LMF via LPP [22]. One report capable of at least in total 9 intra-frequency CSI-RSRP and/or CSI-RSRQ measurements. Applicable to UE capable of reporting any of CSI-RSRP and CSI-RSRQ to LMF via LPP, as indicated in *nr-ECID-MeasSupported-r16*.
Inter-frequency SSB-based measurements for NR E-CID Note 2,3,4,5	1	Inter-frequency SS-RSRP and SS-RSRQ measurements for NR E-CID reported to LMF via LPP [34]. One report capable of at least in total 10 inter-frequency SS-RSRP and SS-RSRQ measurements. Applicable to UE capable of reporting at least one of SS-RSRP and SS-RSRQ to LMF via LPP.

Inter-frequency CSI-RS based measurements for NR E-CID Note 2,3,4,5	1	Inter-frequency CSI-RSRP and CSI-RSRQ measurements for NR E-CID reported to LMF via LPP [22]. One report capable of at least in total 10 inter-frequency CSI-RSRP and CSI-RSRQ measurements. Applicable to UE capable of reporting any of CSI-RSRP and CSI-RSRQ to LMF via LPP, as indicated in *nr-ECID-MeasSupported-r16*.
DL RSTD Note 2,4,5	1	DL RSTD measurement reporting; 1 report capable of multiple (within the UE PRS measurement capability, *nr-DL-TDOA-MeasCapability*, indicated via LPP [34]) DL RSTD measurements and if supported also multiple corresponding DL PRS-RSRP measurements configured for DL-TDOA. Only applicable for UE capable of reporting measurements for DL-TDOA to LMF via LPP [34].
UE Rx-Tx Note 2,4,5	1	UE Rx-Tx measurement reporting; 1 report capable of multiple (within the UE PRS measurement capability, *nr-DL-PRS-MeasCapability*, indicated via LPP [34] for multi-RTT) UE Rx-Tx measurements and if supported also multiple corresponding DL PRS-RSRP measurements configured for multi-RTT. Only applicable for UE capable of reporting measurements for multi-RTT to LMF via LPP [34].
DL PRS-RSRP Note 2,4,5	1	DL PRS-RSRP measurement reporting; 1 report capable of multiple (within the UE PRS measurement capability, *nr-DL-PRS-MeasCapability*, indicated via LPP [34] for AoD) DL PRS-RSRP measurements configured for DL-AoD. Only applicable for UE capable of reporting measurements for DL-AoD to LMF via LPP [34].
SRS-RSRP Note 2,3,4,5	1	SRS-RSRP measurement reporting for CLI; 1 report capable of up to 32 SRS resources measurements. Only applicable for UE supporting *cli-SRS-RSRP-Meas-r16*.
CLI-RSSI Note 2,3,4,5	1	CLI-RSSI measurement reporting for CLI; 1 report capable of up to 64 CLi-RSSI resources measurements. Only applicable for UE supporting *cli-RSSI-Meas-r16*.
NOTE 1: When the UE is configured with PSCell and SCell carrier frequencies, E_{cat} for Intra-frequency is applied per corresponding NR serving frequency. NOTE 2: Applicable for UE configured with SA NR operation mode. NOTE 3: Applicable for UE configured with EN-DC operation mode. NOTE 4: Applicable for UE configured with NE-DC operation mode. NOTE 5: Applicable for UE configured with NR-DC operation mode.		

9.1.5 Carrier-specific scaling factor

This clause specifies the derivation of carrier-specific scaling factor (CSSF) values, which scales the measurement delay requirements given in clause 9.2, 9.3, 9.4, and NR PRS-based positioning measurements in clause 9.9 and CSI-RS based L3 measurement in clause 9.10 when UE is configured to monitor multiple measurement objects. The CSSF values are categorized into $CSSF_{outside\_gap,i}$ and $CSSF_{within\_gap,i}$, for the measurements conducted outside measurement gaps and within measurement gaps, respectively.

9.1.5.1 Monitoring of multiple layers outside gaps

The carrier-specific scaling factor $CSSF_{outside\_gap,i}$ for measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement with no measurement gap in clause 9.2.5, when none of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement with no measurement gap in clause 9.2.5, when part of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based intra-frequency measurement in clause xxx, when none of CSI-RS resources for L3 measurement of this intra-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based intra-frequency measurement in clause xxx, when all CSI-RS resources for L3 measurement of this intra-frequency measurement object are partially overlapped by the measurement gap.- SSB-based inter-frequency measurement with no measurement gap in clause 9.3.9, when none of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

- SSB-based inter-frequency measurement with no measurement gap in clause 9.3.9, when part of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, if UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network.

UE is expected to conduct the measurement of this measurement object *i* only outside the measurement gaps.

The number of frequency layers for SSB measurements shall include the total number of MOs with

- *ssb-ConfigMobility* configured, or

- *ssb-ConfigMobility* not configured but *csi-rs-ResourceConfigMobility* configured with *associatedSSB.*

If *ssbfrequency*, *smtc1*, *smtc2* and *ssbSubcarrierSpacing* are same in multiple MOs, the multiple MOs are counted as one SSB frequency layer.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, $CSSF_{outside\_gap,i}$ and requirements derived from $CSSF_{outside\_gap,i}$ are not specified.

The UE cell identification and measurement periods derived based on $CSSF_{outside\_gap,i}$ in clauses 9.2.5.1, 9.2.5.2 and 9.10.2 may be extended for measurement objects of which the cell identification and measurement periods are overlapped with $T_{measure\_SFTD1}$ specified in clause 9.3.8 when no measurement gaps are provided.

The requirements in this clause apply provided that

- There are only SCCs in FR2, or
- The SMTC on all CCs in FR2 have the same offset, and one of following conditions is met
  - If *smtc2* is configured on any FR2 CC,
    - All CCs have the same configuration for *smtc1*, and
    - All CCs configured with *smtc2* have the same configuration for *smtc2*
  - If *smtc2* is not configured on any FR2 CC,
    - The total number of different SMTC periodicities on all serving CCs does not exceed 4
    - All CSI-RS resources in the same MO are configured within a periodic 5ms window.

Note: Longer delays for cell identification and measurement periods derived based on $CSSF_{outside\_gap,i}$ in clauses 9.2.5.1, 9.2.5.2, can be expected, if the UE is configured with more than 4 different SMTC periodicities on FR2 serving carriers. The longer delay applies for the FR2 intra-frequency measurement objects with the longest SMTC periodicity/periodicities.

9.1.5.1.1 EN-DC mode: carrier-specific scaling factor for SSB-based and CSI-RS based L3 measurements performed outside gaps

For UE configured with the E-UTRA-NR dual connectivity operation, the carrier-specific scaling factor $CSSF_{outside\_gap,i}$ for intra-frequency SSB-based measurements, inter-frequency SSB-based measurements performed outside measurements gaps and intra-frequency CSI-RS L3 measurement will be as specified in Table 9.1.5.1.1-1.

Table 9.1.5.1.1-1: $CSSF_{outside\_gap,i}$ scaling factor for EN-DC mode

Scenario	$CSSF_{outside\_gap,i}$ for FR1 PSCC	$CSSF_{outside\_gap,i}$ for FR1 SCC	$CSSF_{outside\_gap,i}$ for FR2 PSCC	$CSSF_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is required Note 2	$CSSF_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside\_gap,i}$ for inter-frequency MO with no measurement gp
EN-DC with FR1 only CA	$1+N_{PSCC\_CSIRS}$	$N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}$	N/A	N/A	N/A	$N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}$
EN-DC with FR2 only intra band CA	N/A	N/A	$1+N_{PSCC\_CSIRS}$	N/A	$N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}$	$N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}$
EN-DC with FR2 only inter band CA	N/A	N/A	$1+N_{PSCC\_CSIRS}$	$2x(1+N_{SCC\_CSIRS\_FR2\_NCM})$ Note 3,5	$2\times(N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$	$2\times(N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$
EN-DC with FR1 +FR2 CA (FR1 PSCell) Note 1	$1+N_{PSCC\_CSIRS}$	$2\times(N_{SCC\_SSB}+Y+2xN_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$	N/A	$2x(1+N_{SCC\_CSIRS\_FR2\_NCM})$ Note 3	$2\times(N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$	$2\times(N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$
EN-DC with FR1 +FR2 CA (FR2 PSCell) Note 1	N/A	$N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}$	$1+N_{PSCC\_CSIRS}$	N/A	$N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}$	$N_{SCC\_SSB}+Y+2x N_{SCC\_CSIRS}$
Note 1: Only one NR FR1 operating band and one NR FR2 operating band are included for FR1+FR2 inter-band EN-DC. Note 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2. Note 3: $CSSF_{outside\_gap,i}=1$ if only one SCell is configured and no inter-frequency MO without gap. Note 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG Note 5: Only two NR FR2 operating band are included for EN-DC with FR2 only inter-band CA Note 6: $N_{PSCC\_CSIRS}=1$ if PSCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, $N_{PSCC}=0$. Note 7: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured Note 8: $N_{SCC\_CSIRS\_FR2\_NCM}=1$ if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, $N_{SCC\_CSIRS\_FR2\_NCM}=0$. Note 9: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured						

9.1.5.1.2 SA mode: carrier-specific scaling factor for SSB-based and CSI-RS based L3 measurements performed outside gaps

For UE in SA operation mode, the carrier-specific scaling factor $CSSF_{outside\_gap,i}$ for intra-frequency SSB-based measurements performed outside measurements gaps will be as specified in Table 9.1.5.1.2-1, which shall also be applied for a UE configured with NE-DC operation.

Table 9.1.5.1.2-1: $CSSF_{outside\_gap,i}$ scaling factor for SA mode

Scenario	$CSSF_{outside\_gap,i}$ for FR1 PCC	$CSSF_{outside\_gap,i}$ for FR1 SCC	$CSSF_{outside\_gap,i}$ for FR2 PCC	$CSSF_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is required	$CSSF_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside\_gap,i}$ for inter-frequency MO with no measurement gap
FR1 only CA	$1+N_{PCC\_CSIRS}$	$N_{SCC\_SSB}+Y+2\times N_{SCC\_CSIRS}$	N/A	N/A	N/A	$N_{SCC\_SSB}+Y+2\times N_{SCC\_CSIRS}$
FR2 only intra band CA	N/A	N/A	$1+N_{PCC\_CSIRS}$	N/A	$N_{SCC\_SSB}+Y+2\times N_{SCC\_CSIRS}$	$N_{SCC\_SSB}+Y+2\times N_{SCC\_CSIRS}$
FR2 only inter band CA	N/A	N/A	1	$2*(1+N_{SCC\_CSIRS\_FR2\_NCM})$ Note 3,5	$2\times(N_{SCC\_SSB}+Y+2\times N_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$	$2\times(N_{SCC\_SSB}+Y+2\times N_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$
FR1 +FR2 CA (FR1 PCell) Note 1	$1+N_{PCC\_CSIRS}$	$2\times(N_{SCC\_SSB}+Y+2*N_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$	N/A	$2x(1+N_{SCC\_CSIRS\_FR2\_NCM})$ Note 3,5	$2\times(N_{SCC\_SSB}+Y+2\times N_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$	$2\times(N_{SCC\_SSB}+Y+2\times N_{SCC\_CSIRS}-1-N_{SCC\_CSIRS\_NCM})$

Note 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA.
Note 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.
Note 3: $CSSF_{outside\_gap,i}=1$ if only one SCell is configured and no inter-frequency MO without gap.
Note 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG.
Note 5: Only two NR FR2 operating bands are included for FR2 inter-band CA.
Note 6: $N_{PCC\_CSIRS}=1$ if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, $N_{PSCC}=0$.
Note 7: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
Note 8: $N_{SCC\_CSIRS\_FR2\_NCM}=1$ if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, $N_{SCC\_CSIRS\_FR2\_NCM}=0$.
Note 9: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured

9.1.5.1.3 NR-DC mode: carrier-specific scaling factor for SSB-based and CSI-RS based L3 measurements performed outside gaps

For UE configured with NR-DC operation, the carrier-specific scaling factor $CSSF_{outside\_gap,i}$ for intra-frequency SSB-based measurement, inter-frequency SSB-based measurements performed outside measurements gaps and intra-frequency CSI-RS based L3 measurement will be as specified in Table 9.1.5.1.3-1.

Table 9.1.5.1.3-1: $CSSF_{outside\_gap,i}$ scaling factor for NR-DC mode

Scenario	$CSSF_{outside\_gap,i}$ for FR1 PCC	$CSSF_{outside\_gap,i}$ for FR1 SCC	$CSSF_{outside\_gap,i}$ for FR2 PSCC	$CSSF_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	$CSSF_{outside\_gap,i}$ for inter-frequency MO with no measurement gap
FR1 + FR2 NR-DC (FR1 PCell and FR2 PScell) **Note 1**	$1+N_{PCC\_CSIRS}$	$2\times(N_{SCC\_SSB}+Y+2xN_{SCC\_CSIRS})$	$2x(1+N_{PSCC\_CSIRS})$	$2x(N_{SCC\_SSB}+Y+2x\ N_{SCC\_CSIRS})$	$2x(N_{SCC\_SSB}+Y+2x\ N_{SCC\_CSIRS})$

Note 1: NR-DC in Rel-15 only includes the scenarios where all serving cells in MCG in FR1 and all serving cells in SCG in FR2.
Note 2: $CSSF_{outside\_gap,i}$ =1 if no SCell is configured and no inter-frequency MO without gap.
Note 3: Y is the number of configured inter-frequency SSB based frequency layers without MG that are being measured outside of MG
Note 4: N_{PCC_CSIRS}=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PSCC} =0.
Note 5: N_{PCC_CSIRS}=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PSCC} =0.
Note 6: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
Note 7: $N_{SCC\_CSIRS\_FR2\_NCM}$=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, $N_{SCC\_CSIRS\_FR2\_NCM}$=0.
Note 8: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured

9.1.5.1.4 NE-DC mode: carrier-specific scaling factor for SSB-based and CSI-RS based measurements performed outside gaps

For UE configured with NE-DC operation, the carrier-specific scaling factor $CSSF_{outside\_gap,i}$ for intra-frequency SSB-based measurement and inter-frequency SSB-based measurements performed outside measurements gaps and intra-frequency CSI-RS based L3 measurement will be as specified in Table 9.1.5.1.4-1.

Table 9.1.5.1.4-1: $CSSF_{outside\_gap,i}$ scaling factor for NE-DC mode

Scenario	*CSSF*$_{outside\_gap,i}$ for FR1 PCC	*CSSF*$_{outside\_gap,i}$ for FR1 SCC	*CSSF*$_{outside\_gap,i}$ for FR2 PCC	*CSSF*$_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is required	*CSSF*$_{outside\_gap,i}$ for FR2 SCC where neighbour cell measurement is not required	*CSSF*$_{outside\_gap,i}$ for inter-frequency MO with no measurement gap
NE-DC with FR1 only CA	1+N_{PCC_CSIRS}	N_{SCC_SSB} +Y+2x N_{SCC_CSIRS}	N/A	N/A	N/A	N_{SCC_SSB} +Y+2x N_{SCC_CSIRS}
NE-DC with FR2 only intra band CA	N/A	N/A	1+N_{PCC_CSIRS}	N/A	N_{SCC_SSB} +Y+2x N_{SCC_CSIRS}	N_{SCC_SSB} +Y+2x N_{SCC_CSIRS}
NE-DC with FR2 only inter band CA	N/A	N/A	1+N_{PCC_CSIRS}	2*(1+ $N_{SCC\_CSIRS\_FR2\_NCM}$) Note 3,5	2×(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS} -1- $N_{SCC\_CSIRS\_NCM}$)	2×(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS} -1- $N_{SCC\_CSIRS\_NCM}$)
NE-DC with FR1 +FR2 CA (FR1 PCell) Note 1	1+N_{PCC_CSIRS}	2×(N_{SCC_SSB} +Y+2* N_{SCC_CSIRS} - 1- $N_{SCC\_CSIRS\_NCM}$)	N/A	2x(1+ $N_{SCC\_CSIRS\_FR2\_NCM}$) Note 3,5	2×(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS} -1- $N_{SCC\_CSIRS\_NCM}$)	2×(N_{SCC_SSB} +Y+2x N_{SCC_CSIRS} -1- $N_{SCC\_CSIRS\_NCM}$)

Note 1: Only one FR1 operating band and one FR2 operating band are included for FR1+FR2 inter-band CA.
Note 2: Selection of FR2 SCC where neighbour cell measurement is required follows clause 9.2.3.2.
Note 3: $CSSF_{outside\_gap,i}$ =1 if only one SCell is configured and no inter-frequency MO without gap.
Note 4: Y is the number of configured inter-frequency MOs without MG that are being measured outside of MG.
Note 5: Only two NR FR2 operating band are included for NE-DC with FR2 only inter-band CA.
Note 6: N_{PCC_CSIRS}=1 if PCC is with either both SSB and CSI-RS based L3 configured or only CSI-RS based L3 measurement configured; otherwise, N_{PSCC} =0.
Note 7: N_{SCC_CSIRS}=Number of configured SCell(s) with either both SSB and CSI-RS based L3 measurement configured or only CSI-RS based L3 measurement configured
Note 8: $N_{SCC\_CSIRS\_FR2\_NCM}$=1 if FR2 SCC, where neighbour cell measurement is required, is with either both SSB and CSI-RS configured or only CSI-RS measurement configured; otherwise, $N_{SCC\_CSIRS\_FR2\_NCM}$=0.
Note 9: N_{SCC_SSB}=Number of configured SCell(s) with only SSB based L3 measurement configured

9.1.5.2 Monitoring of multiple layers within gaps

The carrier-specific scaling factor $CSSF_{within\_gap,i}$ for a measurement object *i* derived in this chapter is applied to following measurement types:

- SSB-based intra-frequency measurement object with no measurement gap in clause 9.2.5, when all of the SMTC occasions of this intra-frequency measurement object are overlapped by the measurement gap.

- SSB-based intra-frequency measurement object with measurement gap in clause 9.2.6.

-- CSI-RS based inter-frequency measurement in clause xxx, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are overlapped by the measurement gap.

- CSI-RS based inter-frequency measurement in clause xxx, when CSI-RS resources for L3 measurement of this inter-frequency measurement object are partially overlapped by the measurement gap.

- SSB-based inter-frequency measurement object with measurement gap in clause 9.3.4.

  - Including inter-frequency measurement with no measurement gap, when all of the SMTC occasions of this inter-frequency measurement object are overlapped by the measurement gap, if UE supports *interFrequencyMeas-NoGap-r16*.

- E-UTRA Inter-RAT measurement object in clauses 9.4.2 and 9.4.3.

- NR PRS-based measurements for positioning in clause 9.9.
- E-UTRA Inter-RAT RSTD and E-CID measurements in clauses 9.4.4 and 9.4.5.
- NR Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.4).
- E-UTRAN Inter-frequency measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.3) and by the E-UTRAN PSCell (TS 36.133 [15] clause 8.19.3).
- E-UTRAN Inter-frequency RSTD measurement configured by the E-UTRAN PCell (TS 36.133 [15] clause 8.17.15).
- UTRA Inter-RAT measurement object configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.5 to 8.17.12).
- GSM Inter-RAT measurements configured by the E-UTRAN PCell (TS 36.133 [15] clauses 8.17.13 and 8.17.14).

UE is expected to conduct the measurement of this measurement object *i* only within the measurement gaps.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, $CSSF_{within\_gap,i}$ and requirements derived from $CSSF_{outside\_gap,i}$ are not specified.

Number of SSB layers should include SSB for mobility and that as associated SSB for CSI-RS mobility. the ssbfrequency is counted only once if the ssbfrequency for mobility and associated SSB are the same, or ssbfrequency and smtc in multiple MOs are the same.

Editor's note: FFS how to add the layer corresponding to the associated SSB for a MO with only CSI-RS measurement configured

9.1.5.2.1 EN-DC mode: carrier-specific scaling factor for SSB and CSI-RS-based L3 measurements performed within gaps

The scaling value $CSSF_{within\_gap,i}$ below has been derived without considering GSM inter-RAT carriers.

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within\_gap,i}$ and is derived as described in this clause.

If measurement object *i* refers to an RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured, $CSSF_{within\_gap,i}$=1. Otherwise, the $CSSF_{within\_gap,i}$ for other measurement objects (including RSTD measurement with periodicity Tprs=160ms) participate in the gap competition are derived as below.

For each measurement gap *j* not used for an RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured within an arbitrary 160ms period, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR carriers, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.
- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time. -
- An inter-RAT UTRA measurement object configured by E-UTRA PCell [15] is a candidate to be measured in all measurement gaps.
- An inter-frequency E-UTRA measurement object configured by E-UTRA PCell [15] is a candidate to be measured in all measurement gaps.
- For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis.

- $M_{intra,i,j}$: Number of intra-frequency measurement objects, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{intra,i,j}$ equals 0.

- $M_{inter,i,j}$: Number of NR inter-frequency layers or NR inter-RAT frequency layer, including both SSB and CSI-RS based, configured by E-UTRA PCell, EUTRA inter-frequency measurement objects configured by E-UTRA PCell, UTRA inter-RAT measurement objects configured by E-UTRA PCell which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{inter,i,j}$ equals 0.

- $M_{tot,i,j} = M_{intra,i,j} + M_{inter,i,j}$: Total number of intra-frequency, inter-frequency and inter-RAT frequency layers which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For each measurement gap *j* used for an RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured within an arbitrary 160ms period, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} =0$.

The carrier specific scaling factor $CSSF_{within\_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within\_gap,i}= \max(\text{ceil}(R_i \times M_{tot,i,j}))$, where j=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{intra} \times M_{intra,i,j})$ in gaps where $M_{inter,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $\text{ceil}(R_i \times M_{intra,i,j})$ in gaps where $M_{inter,i,j}=0$, where j=0…(160/MGRP)-1
- measurement object *i* is an inter-frequency or inter-RAT measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{inter} \times M_{inter,i,j})$ in gaps where $M_{intra,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $\text{ceil}(R_i \times M_{inter,i,j})$ in gaps where $M_{intra,i,j}=0$, where j=0…(160/MGRP)-1

Where R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured within an arbitrary 1280ms period.

9.1.5.2.2 SA mode: carrier-specific scaling factor for SSB and CSI-RS-based L3 measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within\_gap,i}$ and is derived as described in this clause.

If measurement object *i* refers to a long-periodicity measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured, or

- an NR measurement for positioning based on PRS configurations in Table 9.1.5.2.2-1

then $CSSF_{within\_gap,i}$=1. Otherwise, the $CSSF_{within\_gap,i}$ for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160ms) participate in the gap competition and the $CSSF_{within\_gap,i}$ are derived as below.

Table 9.1.5.2.2-1: PRS configurations for long-periodicity NR measurements for positioning

[PRS periodicity] (ms)	DL-PRS-MutingPattern configuration
320, 640, … ,10240	[With or without muting]
Other values (≤ 160)	FFS

For each measurement gap *j* not used for a long-periodicity measurement defined above, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and [TBD for NR positioning measurements] which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

- An inter-frequency SFTD measurement object, if to be measured with measurement gaps, is a candidate to be measured in all measurement gaps.

- For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

- $M_{intra,i,j}$: Number of intra-frequency measurement objects, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{intra,i,j}$ equals 0.

- $M_{inter,i,j}$: Number of NR inter-frequency, EUTRA inter-RAT and UTRA inter-RAT frequency layers, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{inter,i,j}$ equals 0.

- $M_{tot,i,j} = M_{intra,i,j} + M_{inter,i,j}$: Total number of intra-frequency, inter-frequency and inter-RAT frequncy layers and [TBD for NR positioning measurements] which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} =0$. The carrier specific scaling factor $CSSF_{within\_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within\_gap,i}= \max(\text{ceil}(R_i \times M_{tot,i,j}))$, where j=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is an intra-frequency measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{intra} \times M_{intra,i,j})$ in gaps where $M_{inter,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $\text{ceil}(R_i \times M_{intra,i,j})$ in gaps where $M_{inter,i,j}=0$, where j=0…(160/MGRP)-1
- measurement object *i* is an inter-frequency or inter-RAT measurement object or [TBD for NR positioning measurements], $CSSF_{within\_gap,i}$ is the maximum among
  - $\text{ceil}(R_i \times K_{inter} \times M_{inter,i,j})$ in gaps where $M_{intra,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $\text{ceil}(R_i \times M_{inter,i,j})$ in gaps where $M_{intra,i,j}=0$, where j=0…(160/MGRP)-1

Where R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

$CSSF_{within\_gap,k}$=1 during $T_{Detect,\ E\text{-}UTRAN\ FDD}$ specified in clause 9.4.4.1.2.2 and $T_{Detect,\ E\text{-}UTRAN\ TDD}$ specified in clause 9.4.4.2.2.2, where k is the carrier frequency where the UE is performing cell detection of the inter-RAT E-UTRA OTDOA assistance data reference cell when acquiring the subframe and slot timing of the cell according to clause 9.4.4. In this case, the UE cell identification and measurement periods derived based on $CSSF_{within\_gap,i}$ in clauses 9.2.5.1, 9.2.5.2, 9.2.6.2, 9.2.6.3, 9.3.4, 9.3.5, 9.4.2.2, 9.4.2.3 and 9.10.2 may be extended for measurement objects of which the cell identification and measurement periods are overlapped with $T_{Detect,\ E\text{-}UTRAN\ FDD}$ and $T_{Detect,\ E\text{-}UTRAN\ TDD}$.

9.1.5.2.3 NE-DC: carrier-specific scaling factor for SSB-based and CSI-RS based L3 measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within\_gap,i}$ and is derived as described in this clause.

If measurement object *i* refers to a long-periodicty measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured, or
- an NR measurement for positioning based on PRS configurations in Table 9.1.5.2.2-1

then $CSSF_{within\_gap,i}$=1. Otherwise, the $CSSF_{within\_gap,i}$ for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160ms) participate in the gap competition are derived as below.

For each measurement gap *j* not used for a long-periodicity measurement defined above, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and [TBD for NR positioning measurements] which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.
- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.
- An inter-RAT measurement object is a candidate to be measured in all measurement gaps.
- An inter-frequency E-UTRA measurement object is a candidate to be measured in all measurement gaps.

For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

If the number of configured interfrequency and interRAT measuerement objects and [TBD for NR positioning measurements] is non-zero and the UE is configured with per UE gaps, or if the UE is configured with per FR gaps:

FR1 and FR2 intrafrequency measurement objects belong to group A

Interfrequency and interRAT measurement objects belong to group B

$M_{groupA,i,j}$: Sum of the number of FR1 intra-frequency measurement objects $M_{intra\text{-}FR1,i,j}$ and the number of FR2 intra-frequency measurement objects $M_{intra\text{-}FR2,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupA,i,j}$ equals 0.

$M_{groupBi,j}$: Number of NR inter-frequency, EUTRA inter-RAT and UTRA inter-RAT measurement objects, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupB,i,j}$ equals 0.

If the number of configured inter-frequency and inter-RAT measuerement objects and [TBD for NR positioning measurements] is zero and the UE is configured with per UE gaps:

FR1 intrafrequency measurement objects belong to group A

FR2 intrafrequency measurement objects belong to group B

$M_{groupA,i,j}$: The number of FR1 intrafrequency measurement objects $M_{intra\text{-}FR1,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupA,i,j}$ equals 0.

$M_{groupBi,j}$: The number of FR2 intrafrequency measurement objects $M_{intra\text{-}FR2,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupB,i,j}$ equals 0.

$M_{tot,i,j} = M_{groupA,i,j} + M_{groupB,i,j}$: Total number of group A and group B measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} =0$. The carrier specific scaling factor $CSSF_{within\_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within\_gap,i}= \max(\text{ceil}(R_i\times M_{tot,i,j}))$, where j=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is a group A measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - $\text{ceil}(R_i\times K_{intra}\times M_{groupA,i,j})$ in gaps where $M_{groupB,i,j}\neq 0$, where j=0…(160/MGRP)-1
  - $\text{ceil}(R_i\times M_{groupA,i,j})$ in gaps where $M_{groupB,i,j}=0$, where j=0…(160/MGRP)-1
- measurement object *i* is an group B measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - $\text{ceil}(R_i\times K_{inter}\times M_{groupBi,j})$ in gaps where $M_{groupA,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $\text{ceil}(R_i\times M_{groupB,i,j})$ in gaps where $M_{groupA,i,j}=0$, where j=0…(160/MGRP)-1

Where R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

9.1.5.2.4 NR-DC: carrier-specific scaling factor for SSB-based and CSI-RS-based L3 measurements performed within gaps

When one or more measurement objects are monitored within measurement gaps, the carrier specific scaling factor for a target measurement object with index *i* is designated as $CSSF_{within\_gap,i}$ and is derived as described in this clause.

If measurement object *i* refers to a long-periodicity measurement which is any of:

- an E-UTRA RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured, or
- an NR positioning measurement corresponding to a positioning frequency layer with configurations of maximum *DL-PRS-Periodicity* and maximum bitmap size of *DL-PRS-MutingPattern* among its PRS resource sets as in Table 9.1.5.2.2-1

then $CSSF_{within\_gap,i}$=1. Otherwise, the $CSSF_{within\_gap,i}$ for other measurement objects (including E-UTRA RSTD measurement with periodicity Tprs=160ms) participate in the gap competition and the $CSSF_{within\_gap,i}$ are derived as below.

For each measurement gap *j* not used for an RSTD measurement with periodicity Tprs>160ms or with periodicity Tprs=160ms but *prs-MutingInfo-r9* is configured within an arbitrary 160ms period, count the total number of intra-frequency measurement objects and inter-frequency/inter-RAT measurement objects and [TBD for NR positioning measurements] which are candidates to be measured within the gap *j*.

- An NR measurement object with SSB measurement configured is a candidate to be measured in a gap if its SMTC duration is fully covered by the MGL excluding RF switching time. For intra-frequency NR measurement objects, if the higher layer in TS 38.331 [2] signaling of *smtc2* is configured, the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc2*; otherwise the assumed periodicity of SMTC occasions corresponds to the value of higher layer parameter *smtc1*.
- An NR measurement object with CSI-RS measurement configured is a candidate to be measured in a gap if the window confining all CSI-RS resources are fully covered by the MGL excluding RF switching time.

  For UEs which support and are configured with per FR gaps, the counting is done on a per FR basis, and for UEs which are configured with per UE gaps the counting is done on a per UE basis. For UEs which support and are configured with per FR gaps, the CSSF requirements do not apply when NR PRS measurement in one FR gap collides with SSB/CSI-RS/PRS measurements in the other FR gap in time domain.

  If the number of configured interfrequency and interRAT measeurement objects and [TBD for NR positioning measurements] is non-zero and the UE is configured with per UE gaps, or if the UE is configured with per FR gaps:

FR1 and FR2 intrafrequency measurement objects belong to group A

Interfrequency and interRAT measurement objects and [TBD for NR positioning measurements] belong to group B

$M_{groupA,i,j}$: Sum of the number of FR1 intra-frequency measurement objects $M_{intra\text{-}FR1,i,j}$ and the number of FR2 intra-frequency measurement objects $M_{intra\text{-}FR2,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupA,i,j}$ equals 0.

$M_{groupBi,j}$: Number of NR inter-frequency, EUTRA inter-RAT and UTRA inter-RAT measurement objects and [TBD for NR positioning measurements] , including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupB,i,j}$ equals 0.

If the number of configured interfrequency and interRAT measuerement objects and [TBD for NR positioning measurements] is zero and the UE is configured with per UE gaps:

FR1 intrafrequency measurement objects belong to group A

FR2 intrafrequency measurement objects belong to group B

$M_{groupA,i,j}$: The number of FR1 intrafrequency measurement objects $M_{intra\text{-}FR1,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupA,i,j}$ equals 0.

$M_{groupBi,j}$: The number of FR2 intrafrequency measurement objects $M_{intra\text{-}FR2,i,j}$, including both SSB and CSI-RS based, which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{groupB,i,j}$ equals 0.

$M_{tot,i,j} = M_{groupA,i,j} + M_{groupB,i,j}$: Total number of group A and group B measurement objects which are candidates to be measured in gap *j* where the measurement object *i* is also a candidate. Otherwise $M_{tot,i,j}$ equals 0.

For each measurement gap *j* used for a long-periodicity measurement defined above, $M_{intra,i,j} = M_{inter,i,j} = M_{tot,i,j} = 0$. The carrier specific scaling factor $CSSF_{within\_gap,i}$ is given by:

If *measGapSharingScheme* is equal sharing, $CSSF_{within\_gap,i} = \max(\mathrm{ceil}(R_i \times M_{tot,i,j}))$, where j=0…(160/MGRP)-1

If *measGapSharingScheme* is not equal sharing and

- measurement object *i* is a group A measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - $\mathrm{ceil}(R_i \times K_{intra} \times M_{groupA,i,j})$ in gaps where $M_{groupB,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $\mathrm{ceil}(R_i \times M_{groupA,i,j})$ in gaps where $M_{groupB,i,j}=0$, where j=0…(160/MGRP)-1
- measurement object *i* is an group B measurement object, $CSSF_{within\_gap,i}$ is the maximum among
  - $\mathrm{ceil}(R_i \times K_{inter} \times M_{groupBi,j})$ in gaps where $M_{groupA,i,j} \neq 0$, where j=0…(160/MGRP)-1
  - $\mathrm{ceil}(R_i \times M_{groupB,i,j})$ in gaps where $M_{groupA,i,j}=0$, where j=0…(160/MGRP)-1

R_i is the maximal ratio of the number of measurement gap where measurement object *i* is a candidate to be measured over the number of measurement gap where measurement object *i* is a candidate and not used for a long-periodicity measurement defined above.

9.1.5.2.5 SA mode: carrier-specific scaling factor for PRS-based measurements performed within gaps

The requirements in this clause apply for NR PRS-based measurements for positioning in clause 9.9.

Editor's note: FFS whether/how the contents of 9.1.5.2.2 can be reused here.

9.1.5.2.6 NE-DC: carrier-specific scaling factor for PRS-based measurements performed within gaps

The requirements in this clause apply for NR PRS-based measurements for positioning in clause 9.9.

Editor's note: FFS whether/how the contents of 9.1.5.2.3 can be reused here.

9.1.5.2.7 NR-DC: carrier-specific scaling factor for PRS-based measurements performed within gaps

The requirements in this clause apply for NR PRS-based measurements for positioning in clause 9.9.

Editor's note: FFS whether/how the contents of 9.1.5.2.4 can be reused here.

9.1.6 Minimum requirement at transitions

When the measurement on one intra-frequency measurement object transitions from measurements performed outside gaps to measurements performed within gaps or vice versa during one measurement period, the cell identification and measurement period requirements with the longer delay apply.

The carrier-specific scaling factor specified in clause 9.1.5 that applies to the other impacted measurement objects will also apply based on the longer measurement or cell identification delay before or after the transition.

When the UE transitions between DRX and non-DRX or when DRX cycle periodicity changes, the cell identification and measurement period requirements apply based on the longer delay before or after the transition.

Subsequent to this measurement period, the cell identification and measurement period requirements on each measurement object are corresponding to the second mode after transition.

9.2 NR intra-frequency measurements

9.2.1 Introduction

A measurement is defined as a SSB based intra-frequency measurement provided the centre frequency of the SSB of the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell or the PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE can perform intra-frequency SSB based measurements without measurement gaps if

- the UE indicates 'no-gap' via *intraFreq-needForGap* for intra-frequency measurement, or
- the SSB is completely contained in the active BWP of the UE, or
- the active downlink BWP is initial BWP[3].

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2.5.3.

SSB based measurements are configured along with one or two measurement timing configuration(s) (SMTC(s)) which provides periodicity, duration and offset information on a window of up to 5ms where the measurements are to be performed. For intra-frequency connected mode measurements, up to two measurement window periodicities may be configured. A single measurement window offset and measurement duration are configured per intra-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time. Switching time is 0.5ms for frequency range FR1 and 0.25ms for frequency range FR2.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

9.2.2 Requirements applicability

The requirements in clause 9.2 apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in clauses 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding Band,
- SS-SINR related side conditions given in clauses 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding Band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding Band.

9.2.3 Number of cells and number of SSB

9.2.3.1 Requirements for FR1

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 8 identified cells, and
- 14 SSBs with different SSB index and/or PCI on the intra-frequency layer, where the number of SSBs in the serving cell (except for the SCell) is not smaller than the number of configured RLM-RS SSB resources.

9.2.3.2 Requirements for FR2

For one single intra-frequency layer in a band, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 6 identified cells, and
- 24 SSBs with different SSB index and/or PCI,

where this single intra-frequency layer shall be:

- PCC when UE is configured with SA NR operation mode with PCC in the band; or
- PSCC when UE is configured with EN-DC with PSCC in the band; or
- PSCC when UE is configured with NR-DC with PSCC in the band; or
- One of the SCCs on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band, so that the selected SCC shall be an SCC where the UE is configured with SS-RSRP measurement reporting if such SCC exists, otherwise the selected SCC is determined by UE implementation.

The UE shall also be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least 2 SSBs on serving cell for each of the other intra-frequency layer(s) in the same band.

9.2.4 Measurement Reporting Requirements

9.2.4.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.3.1 (RSRP for FR2), 10.1.7.1 (RSRQ for FR1), 10.1.8.1 (RSRQ for FR2), 10.1.12.1 (RS-SINR for FR1) and 10.1.13.1 (RS-SINR for FR2).

9.2.4.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.3.1 (RSRP for FR2), 10.1.7.1 (RSRQ for FR1), 10.1.8.1 (RSRQ for FR2), 10.1.12.1 (RS-SINR for FR1) and 10.1.13.1 (RS-SINR for FR2).

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2.4.3.

9.2.4.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.2.1 (RSRP for FR1), 10.1.3.1 (RSRP for FR2), 10.1.7.1 (RSRQ for FR1), 10.1.8.1 (RSRQ for FR2), 10.1.12.1 (RS-SINR for FR1) and 10.1.13.1 (RS-SINR for FR2).

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify\ intra\ with\ index}$ or $T_{identify\ intra\ without\ index}$ defined in clause 9.2.5.1 or clause 9.2.6.2. When L3 filtering is used an additional delay can be expected. In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index}$ as defined in clause 9.2.5.1 or clause 9.2.6.2. If a cell which has been detectable at least for the time period $T_{identify\ intra\ without\ index}$ or $T_{identify\ intra\ with\ index}$ defined in clause 9.2.5.1 or clause 9.2.6.2 becomes undetectable for a period $\leq$ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than $T_{SSB\_measurement\_period\_intra}$ provided the timing to that cell has not changed more than $\pm$ 3200 T_c while the measurement gap has not been available and L3 filtering has not been used. When L3 filtering is used, an additional delay can be expected. In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

9.2.5 Intrafrequency measurements without measurement gaps

9.2.5.1 Intrafrequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within $T_{identify\_intra\_without\_index}$ if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{identify\_intra\_with\_index}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify\_intra\_without\_index.}$ It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

$$T_{identify\_intra\_without\_index} = (T_{PSS/SSS\_sync\_intra} + T_{SSB\_measurement\_period\_intra})\ ms$$

$$T_{identify\_intra\_with\_index} = (T_{PSS/SSS\_sync\_intra} + T_{SSB\_measurement\_period\_intra} + T_{SSB\_time\_index\_intra})\ ms$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2.5.1-1, 9.2.5.1-2, 9.2.5.1-4 (deactivated SCell) or 9.2.5.1-5 (deactivated SCell)

$T_{SSB\_time\_index\_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2.5.1-3 or 9.2.5.1-6 (deactivated SCell)

$T_{SSB\_measurement\_period\_intra}$: equal to a measurement period of SSB based measurement given in table 9.2.5.2-1, table 9.2.5.2-2 table 9.2.5.2-3 (deactivated SCell) or 9.2.5.2-4(deactivated SCell)

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined

according to $CSSF_{outside\_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps.

if the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

$M_{pss/sss\_sync\_w/o\_gaps}$: For a UE supporting FR2 power class 1, $M_{pss/sss\_sync\_w/o\_gaps}$ =40. For a UE supporting power class 2, $M_{pss/sss\_sync\_w/o\_gaps}$ =24. For a UE supporting FR2 power class 3, $M_{pss/sss\_sync\_w/o\_gaps}$ =24. For a UE supporting FR2 power class 4, $M_{pss/sss\_sync\_w/o\_gaps}$ =24

$M_{meas\_period\_w/o\_gaps}$: For a UE supporting power class 1, $M_{meas\_period\_w/o\_gaps}$ =40. For a UE supporting FR2 power class 2, $M_{meas\_period\_w/o\_gaps}$ =24. For a UE supporting power class 3, $M_{meas\_period\_w/o\_gaps}$ =24. For a UE supporting power class 4, $M_{meas\_period\_w/o\_gaps}$ =24.

When intra-frequency SMTC is fully non overlapping with measurement gaps or intra-frequency SMTC is fully overlapping with MGs, Kp=1

When intra-frequency SMTC is partially overlapping with measurement gaps, Kp = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP

If the higher layer signaling in TS38.331 [2] signalling of *smtc2* is present and smtc1 is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index}$

For FR2,

$K_{layer1\_measurement}$=1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are indicated by the union of *SSB-ToMeasure* from all MOs which can be merged. and RSSI symbols are indicated by *SS-RSSI-Measurement*;

  $K_{layer1\_measurement}$=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

If SCG DRX is in use, intrafrequency cell identification requirements specified in Table 9.2.5.1-1, Table 9.2.5.1-2, Table 9.2.5.1-3, Table 9.2.5.1-4, Table 9.2.5.1-5 and Table 9.2.5.1-6 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 9.2.5.1-1: Time period for PSS/SSS detection, (Frequency range FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600ms, ceil(5 x K_p) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320ms	max(600ms, ceil(M2 $^{Note\ 2}$x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	ceil(5 x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1.	

Table 9.2.5.1-2: Time period for PSS/SSS detection, (Frequency range FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600ms, ceil($M_{pss/sss\_sync\_w/o\_gaps}$ x K_p x $K_{layer1\_measurement}$) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320ms	max(600ms, ceil(1.5 x $M_{pss/sss\_sync\_w/o\_gaps}$ x K_p x $K_{layer1\_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	ceil($M_{pss/sss\_sync\_w/o\_gaps}$ x K_p x $K_{layer1\_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2.5.1-3: Time period for time index detection (FR1)

DRX cycle	$T_{SSB\_time\_index\_intra}$
No DRX	max(120ms, ceil(3 x K_p) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320ms	max(120ms, ceil (M2 $^{Note\ 2}$ x 3 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	Ceil(3 x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms;,otherwise M2=1	

Table 9.2.5.1-4: Time period for PSS/SSS detection, deactivated SCell (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	5 x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	5 x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320ms	5 x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.1-5: Time period for PSS/SSS detection, deactivated SCell (FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	$M_{pss/sss\_sync\_w/o\_gaps}$ x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	$M_{pss/sss\_sync\_w/o\_gaps}$ x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320ms	$M_{pss/sss\_sync\_w/o\_gaps}$ x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.1-6: Time period for time index detection, deactivated SCell (FR1)

DRX cycle	$T_{SSB\_time\_index\_intra}$
No DRX	3 x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	3 x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320ms	3 x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.1-7: Void

Table 9.2.5.1-8: Void

9.2.5.2 Measurement period

The measurement period for intrafrequency measurements without gaps is as shown in table 9.2.5.2-1, 9.2.5.2-2, 9.2.5.2-3 (deactivated SCell) or 9.2.5.2-4(deactivated SCell). The measurement period for intrafrequency measurements without gaps is as shown in table 9.2.5.2-1, 9.2.5.2-2, 9.2.5.2-3 (deactivated SCell) or 9.2.5.2-4(deactivated SCell). When *highSpeedMeasFlag-r16* is configured, $T_{SSB\_measurement\_period\_intra}$ is specified in Table 9.2.5.2-5.

If the higher layer signaling in TS38.331 [2] signalling of *smtc2* is present and smtc1 is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for $T_{SSB\_measurement\_period\_intra}$

If SCG DRX is in use, intrafrequency measurement period requirements specified in Table 9.2.5.2-1, Table 9.2.5.2-2, Table 9.2.5.2-3 and Table 9.2.5.2-4 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 9.2.5.2-1: Measurement period for intra-frequency measurements without gaps(FR1)

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX	max(200ms, ceil(5 x K_p) x SMTC period)$^{\text{Note 1}}$ x $CSSF_{intra}$
DRX cycle≤ 320ms	max(200ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	ceil(5 x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2.5.2-2: Measurement period for intra-frequency measurements without gaps(FR2)

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX	max(400ms, ceil($M_{meas\_period\_w/o\_gaps}$ x K_p x $K_{layer1\_measurement}$) x SMTC period)$^{\text{Note 1}}$ x $CSSF_{intra}$
DRX cycle≤ 320ms	max(400ms, ceil(1.5x $M_{meas\_period\_w/o\_gaps}$ x K_p x $K_{layer1\_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	ceil($M_{meas\_period\_w/o\_gaps}$ xK_p x $K_{layer1\_measurement}$) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.2.5.2-3: Measurement period for intra-frequency measurements without gaps (deactivated SCell) (FR1)

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX	5 x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	5 x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320ms	5 x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.2-4: Measurement period for intra-frequency measurements without gaps (deactivated SCell) (FR2)

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX	$M_{meas\_period\_w/o\_gaps}$ x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	$M_{meas\_period\_w/o\_gaps}$ x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle> 320ms	$M_{meas\_period\_w/o\_gaps}$ x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$

Table 9.2.5.2-5: $T_{SSB\_measurement\_period\_intra}$ When *highSpeedMeasFlag-r16* is configured (Frequency range FR1

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX Note 2	max(200ms, ceil(5 x K_p) x SMTC period)Note 1 x $CSSF_{intra}$
DRX cycle≤ 160ms	max(200ms, ceil(5 x M2 Note 2 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
160ms < DRX cycle≤ 320ms	ceil(4 x M2 Note 2 x K_p) x max(SMTC period,DRX cycle)
DRX cycle>320ms	ceil(Y Note 3 x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 NOTE 3: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms	

9.2.5.3 Scheduling availability of UE during intra-frequency measurements

UE shall be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union of *SSB-ToMeasure* from all MOs which can be merged [2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

9.2.5.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the SMTC periodicity follows *smtc2*; Otherwise SMTC periodicity follows *smtc1*.

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.2.5.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2* is configured(in TS 38.331 [2]), the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

- If *deriveSSB_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.2.5.3.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP or SS-SINR measurement on an FR2 intra-frequency cell

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration (The signaling *deriveSSB_IndexFromCell* is always enabled for FR2). If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 intra-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration (The signaling *deriveSSB_IndexFromCellc* is always enabled for FR2). If the high layer signalling of *smtc2* is configured in TS 38.331 [2], the SMTC periodicity follows *smtc2*; Otherwise the SMTC periodicity follows *smtc1*.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to SS-RSRP, SS-RSRQ or SS-SINR measurement on an FR2 intra-frequency cell in different bands, provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

If following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE is expected to receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE is expected to receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

9.2.5.3.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 serving cell frequency layer.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 serving cell frequency layer.

9.2.5.4 SFTD Measurements between PCell and PSCell

9.2.5.4.1 Introduction

This clause contains SFTD measurement requirements for UE which supports NR-DC and is configured with a PSCell in RRC_CONNECTED state. The UE shall perform SFTD measurement between PCell and PSCell, and report the SFTD result with/without SS-RSRP after the network requests with *reportType* for the associated *reportConfig* set to *reportSFTD*. The overall delay includes RRC procedure delay defined in clause 12 in TS 38.331 [2], and SFTD measurement reporting delay in clause 9.2.5.4.3..

9.2.5.4.2 SFTD Measurement delay

When no DRX is used in either of PCell and PSCell, the physical layer measurement period of the SFTD measurement shall be $T_{measure\_SFTD1}$ = max(200, 5 x SMTC period) ms, where the SMTC period refers to the maximum between the configured SMTC period in PCell and PSCell.

When DRX is used in either of the PCell or the PSCell, or in both PCell and PSCell, the physical layer measurement period ($T_{measure\_SFTD1}$) of the SFTD measurement shall be as specified in Table 9.2.5.4.2-1.

Table 9.2.5.4.2-1: SFTD measurement requirement when DRX is used

DRX cycle length (s) Note 3	$T_{measure\_SFTD1}$ (s)
≤0.04	max(0.2, 5 x SMTC period) (Note2)
0.04<DRX cycle≤0.32	8 x max(DRX cycle, SMTC period)
0.32<DRX cycle≤10.24	5 x DRX cycle
Note 1: SMTC period in this table refers to the maximum between the configured SMTC period in PCell and PSCell. Note 2: Number of DRX cycles depends upon the DRX cycle in use Note 3: DRX cycle length in this table refers to the DRX cycle length configured for PCell or PSCell. When DRX is used in both PCell and PSCell, DRX cycle length in this table refers to the longer of the DRX cycle lengths for PCell and PSCell.	

If PSCell is changed without changing carrier frequency of PSCell, while the UE is performing SFTD measurements, the UE shall still meet SFTD measurement and accuracy requirements for the new PSCell. In this case the UE shall restart the SFTD measurement, and the total physical layer measurement period shall not exceed $T_{measure\_SFTD2}$ as defined by the following expression:

$$T_{measure\_SFTD2} = (M+1)*(T_{measure\_SFTD1}) + M*T_{PSCell\_change\_NRDC}$$

where:

M is the number of times the NR PSCell is changed over the measurement period ($T_{measure\_SFTD2}$), and

$T_{PSCell\_change\_NRDC}$ is the time necessary to change the PSCell; it can be up to 25ms.

If PCell is changed, or if PSCell is changed with different carrier frequency from PSCell, the UE shall terminate SFTD measurements.

The measurement accuracy for the SFTD measurement when DRX is used as well as when no DRX is used shall be as specified in the clause 10.1.21.

9.2.5.4.3 SFTD Measurement Reporting Delay

The SFTD measurement reporting delay is defined as the time between a command that will trigger an SFTD measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes any delay caused by no UL resources available for UE to send the measurement report.

The SFTD measurement reporting delay shall be less than measurement period defined in clause 9.2.5.4.2 plus the RRC procedure delay defined in TS 38.331 [2].

9.2.6 Intra-frequency measurements with measurement gaps

9.2.6.1 Void

9.2.6.2 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra frequency cell within $T_{identify\_intra\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{identify\_intra\_with\_index.}$ The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify\_intra\_without\_index.}$ It is assumed that *deriveSSB-IndexFromCell* is always enabled for FR1 TDD and FR2.

$$T_{identify\_intra\_without\_index} = T_{PSS/SSS\_sync\_intra} + T_{SSB\_measurement\_period\_intra} \text{ ms}$$

$$T_{identify\_intra\_with\_index} = T_{PSS/SSS\_sync\_ntra} + T_{SSB\_measurement\_period\_intra} + T_{SSB\_time\_index\_intra} \text{ ms}$$

Where:

T_{PSS/SSS_sync_intra}: it is the time period used in PSS/SSS detection given in table 9.2.6.2-1 or 9.2.6.2-2.

$T_{SSB\_time\_index\_intra}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2.6.2-3.

$T_{SSB\_measurement\_period\_intra}$: equal to a measurement period of SSB based measurement given in table 9.2.6.3-1 or 9.2.6.3-2.

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

$M_{pss/sss\_sync\_with\_gaps}$: For a UE supporting FR2 power class 1, $M_{pss/sss\_sync\ with\_gaps}$=40. For a UE supporting FR2 power class 2, $M_{pss/sss\_sync\ with\_gaps}$ =24. For a UE supporting FR2 power class 3, $M_{pss/sss\_sync\ with\_gaps}$ =24. For a UE supporting power class 4, $M_{pss/sss\_sync\ with\_gaps}$ =24

$M_{meas\_period\_ with\_gaps}$: For a UE supporting power class 1, $M_{meas\_period\_ with\_gaps}$ =40. For a UE supporting power class 2, $M_{meas\_period\_ with\_gaps}$ =24. For a UE supporting power class 3, $M_{meas\_period\_ with\_gaps}$ =24. For a UE supporting power class 4, $M_{meas\_period\ with\_gaps}$ =24.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and smtc1 is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for $T_{identify\_intra\_without\_index}$ or $T_{identify\_intra\_with\_index.}$

If SCG DRX is in use, intrafrequency cell identification requirements specified in Table 9.2.6.2-1, Table 9.2.6.2-2, and Table 9.2.6.2-3 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

Table 9.2.6.2-1: Time period for PSS/SSS detection (FR1)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600ms, 5 x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(600ms, ceil(M2[Note 1]x 5) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	5 x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.	

Table 9.2.6.2-2: Time period for PSS/SSS detection (FR2)

DRX cycle	T_{PSS/SSS_sync_intra}
No DRX	max(600ms, $M_{pss/sss\_sync\_with\_gaps}$ x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(600ms, ceil(1.5x $M_{pss/sss\_sync\_with\_gaps}$) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	$M_{pss/sss\_sync\_with\_gaps}$ x max(MGRP, DRX cycle) x $CSSF_{intra}$

Table 9.2.6.2-3: Time period for time index detection (Frequency range FR1)

DRX cycle	$T_{SSB\_time\_index\_intra}$
No DRX	max(120ms, 3 x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(120ms, ceil(M2[Note 1]x 3) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320ms	3 x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: When RRM enhancement for high speed is not configured, M2 = 1.5; When RRM enhancement for high speed is configured, M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1.	

Table 9.2.6.2-7: Void

Table 9.2.6.2-8: Void

9.2.6.3 Intrafrequency Measurement Period

The measurement period for FR1 intrafrequency measurements with gaps is as shown in table 9.2.6.3-1.

The measurement period for FR2 intrafrequency measurements with gaps is as shown in table 9.2.6.3-2.

When *highSpeedMeasFlag-r16* is configured, $T_{SSB\_measurement\_period\_intra}$ is specified in Table 9.2.6.3-3.

If SCG DRX is in use, intrafrequency measurement period requirements specified in Table 9.2.6.3-1and Table 9.2.6.3-2, shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

For either an FR1 or FR2 serving cell, longer measurement period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

Table 9.2.6.3-1: Measurement period for intra-frequency measurements with gaps(FR1)

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX	max(200ms, 5 x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(200ms, ceil(1.5x 5) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	5 x max(MGRP, DRX cycle) x $CSSF_{intra}$

Table 9.2.6.3-2: Measurement period for intra-frequency measurements with gaps(FR2)

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX	max(400ms, $M_{meas\_period\ with\_gaps}$ x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(400ms, ceil(1.5 x $M_{meas\_period\ with\_gaps}$) x max(MGRP, SMTC period, DRX cycle)) Note 1 x $CSSF_{intra}$
DRX cycle>320ms	$M_{meas\_period\ with\_gaps}$ x max(MGRP, DRX cycle) x $CSSF_{intra}$

Table 9.2.6.3-3: Measurement period When *highSpeedMeasFlag-r16* is configured (Frequency Range FR1)

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX	max(200ms, 5 x max(MGRP, SMTC period)) Note 1 x $CSSF_{intra}$
DRX cycle≤ 160ms	max(200ms, ceil(M2 Note 2 x 5) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
160ms < DRX cycle≤ 320ms	max(200ms, ceil(M2 Note 2 x 4) x max(MGRP, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	Y Note 3 x max(MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: M2 = 1.5 if SMTC periodicity > 40 ms, otherwise M2=1 NOTE 3: Y=3 when SMTC <= 40ms, Y=5 when SMTC > 40ms	

9.2A NR intra-frequency measurements with CCA

9.2A.1 Introduction

The requirements in clause 9.2.A apply for intra-frequency measurements on carrier frequency with CCA.

A measurement is defined as a SSB based intra-frequency measurement provided the centre frequency of the SSB of the serving cell indicated for measurement and the centre frequency of the SSB of the neighbour cell are the same, and the subcarrier spacing of the two SSBs are also the same.

The UE shall be able to identify new intra-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell or the PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE can perform intra-frequency SSB based measurements without measurement gaps if

- the SSB is completely contained in the active BWP of the UE, or
- the active downlink BWP is initial BWP[3].

For intra-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.2A.5.3.

SSB based measurements are configured along with one or two measurement timing configuration(s) (SMTC(s)) which provides periodicity, duration and offset information on a window of up to 5ms where the measurements are to be performed. For intra-frequency connected mode measurements, up to two measurement window periodicities may be configured. A single measurement window offset and measurement duration are configured per intra-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time. Switching time is 0.5ms.

In the requirements of clause 9.2A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but *N* candidate SSB positions for the same

SSB index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding period, where:

- For the cell detection procedure: *N* is at least one candidate SSB position (NOTE: the one candidate SSB position for the cell detection shall not be impacted by the set of candidate SSB positions which are already being measured by the UE within the current measurement period of the on-going measurements), and
- For other procedures in clause 9.2A: *N* are the first two successive candidate SSB positions when two or more candidate SSB positions are configured for this SSB index in one discovery burst transmission window, otherwise N is one candidate SSB position;

otherwise the SMTC occasion is considered as available at the UE.

9.2A.2 Requirements applicability

The requirements in clause 9.2A apply, provided:

- The cell being identified or measured is detectable.

An intra-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.27, for a corresponding Band,
- SS-RSRQ related side conditions given in clause 10.1.29, for a corresponding Band,
- SS-SINR related side conditions given in clause 10.1.31, for a corresponding Band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.8 for a corresponding Band.

9.2A.3 Number of cells and number of SSB

For each intra-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 8 identified cells, and
- 14 SSBs with different SSB index and/or PCI on the intra-frequency layer, where the number of SSBs in the serving cell (except for the SCell) is not smaller than the number of configured RLM-RS SSB resources.

9.2A.4 Measurement Reporting Requirements

9.2A.4.1 Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.27, 20.1.29, and 10.1.31, respectively.

9.2A.4.2 Event-triggered Periodic Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.27, 20.1.29, and 10.1.31, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.2A.4.3.

9.2A.4.3 Event Triggered Reporting

Reported RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.27, 20.1.29, and 10.1.31, respectively.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on, and all delays due to UL CCA failures until the successful transmission of the report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{\text{identify intra with index\_CCA}}$ or $T_{\text{identify intra without index\_CCA}}$ defined in clause 9.2A.5.1 or clause 9.2A.6.2. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSBs measured from the Cell being configured remains detectable during the time period $T_{\text{identify\_intra\_without\_index\_CCA}}$ or $T_{\text{identify\_intra\_with\_index\_CCA}}$ as defined in clause 9.2A.5.1 or clause 9.2A.6.2. If a cell which has been detectable at least for the time period $T_{\text{identify intra without index\_CCA}}$ or $T_{\text{identify intra with index\_CCA}}$ defined in clause 9.2A.5.1 or clause 9.2A.6.2 becomes undetectable for a period ≤ 8 seconds and then the cell becomes detectable again with the same spatial reception parameter and triggers an event, the event triggered measurement reporting delay shall be less than $T_{\text{SSB\_measurement\_period\_intra\_CCA}}$ provided the timing to that cell has not changed more than ± 3200 Tc while the measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

9.2A.5 Intra-frequency measurements without measurement gaps

9.2A.5.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra frequency cell within $T_{\text{identify\_intra\_without\_index\_CCA}}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{\text{identify\_intra\_with\_index\_CCA}}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{\text{identify\_intra\_without\_index\_CCA}}$.

$$T_{\text{identify\_intra\_without\_index\_CCA}} = (T_{\text{PSS/SSS\_sync\_intra\_CCA}} + T_{\text{SSB\_measurement\_period\_intra\_CCA}})\ \text{ms}$$

$$T_{\text{identify\_intra\_with\_index CCA}} = (T_{\text{PSS/SSS\_sync\_intra\_CCA}} + T_{\text{SSB\_measurement\_period\_intra\_CCA}} + T_{\text{SSB\_time\_index\_intra\_CCA}})\ \text{ms}$$

Where:

$T_{\text{PSS/SSS\_sync\_intra\_CCA}}$: it is the time period used in PSS/SSS detection given in table 9.2A.5.1-1, 9.2A.5.1-3 (deactivated Scell) .

$T_{\text{SSB\_time\_index\_intra\_CCA}}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2A.5.1-2 or 9.2A.5.1-4 (deactivated SCell).

$T_{\text{SSB\_measurement\_period\_intra\_CCA}}$: equal to a measurement period of SSB based measurement given in table 9.2A.5.2-1, 9.2A.5.2-2 (deactivated Scell). $CSSF_{intra}$: it is a carrier specific scaling factor and is determined

- according to $CSSF_{outside\_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps.

When intra-frequency SMTC is fully non overlapping with measurement gaps or intra-frequency SMTC is fully overlapping with MGs, Kp=1

When intra-frequency SMTC is partially overlapping with measurent gaps, Kp = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP.

If SCG DRX is in use, intra-frequency cell identification requirements specified in Table 9.2A.5.1-1, Table 9.2A.5.1-2, Table 9.2A.5.1-3, and Table 9.2A.5.1-4 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

The requirements apply provided any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3.

Table 9.2A.5.1-1: Time period for PSS/SSS detection

Condition	$T_{PSS/SSS\_sync\_intra\_CCA}$
No DRX	max(600ms, ceil((5+$L_{PSS/SSS}$) x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320ms	max(600ms, ceil(1.5x (5+$L_{PSS/SSS}$) x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	ceil((5+$L_{PSS/SSS}$) x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: $L_{PSS/SSS}$ is the number of SMTC occasions not available at the UE during $T_{PSS/SSS\_sync\_intra\_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS}$< $L_{PSS/SSS,max}$. NOTE 3: $L_{PSS/SSS,max}$ =7 for Max(DRX cycle,SMTC period)≤40ms where DRX cycle is 0 for non-DRX, $L_{PSS/SSS,max}$ =5 for 40ms<Max(DRX cycle,SMTC period)≤320ms, $L_{PSS/SSS,max}$ = 3 for DRX cycle>320ms. NOTE 4: Upon exceeding $L_{PSS/SSS,max}$, the UE is not required to meet the requirements for PSS/SSS detection.	

Table 9.2A.5.1-2: Time period for time index detection

Condition	$T_{SSB\_time\_index\_intra\_CCA}$
No DRX	max(120ms, ceil((3+L_{ind}) x K_p) x SMTC period)[Note 1] x $CSSF_{intra}$
DRX cycle≤ 320ms	max(120ms, ceil (1.5 x (3+L_{ind}) x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	Ceil((3+L_{ind}) x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: L_{ind} is the number of SMTC occasions not available at the UE during $T_{SSB\_time\_index\_intra\_CCA}$ for index detection, where $L_{ind} \le L_{ind,max}$. NOTE 3: $L_{ind,max}$ = 5 for Max(DRX cycle,SMTC period)≤40ms where DRX cycle is 0 for non-DRX, $L_{ind,max}$ = 3 for 40ms<Max(DRX cycle,SMTC period)≤320ms, $L_{ind,max}$ =2 for DRX cycle>320ms. NOTE 4: Upon exceeding $L_{ind,max}$ over the period of time $T_{SSB\_time\_index\_intra\_CCA}$, the UE has to restart the time index detection procedure.	

Table 9.2A.5.1-3: Time period for PSS/SSS detection, deactivated SCell

Condition	$T_{PSS/SSS\_sync\_intra\_CCA}$
No DRX	(5 + $L_{PSS/SSS,deact}$) x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	(5 + $L_{PSS/SSS, deact}$) x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle>320ms	(5 + $L_{PSS/SSS, deact}$) x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: $L_{PSS/SSS, deact}$ is the number of SMTC occasions not available at the UE during $T_{PSS/SSS\_sync\_intra\_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS, deact}$< $L_{PSS/SSS, deact,max,}$ NOTE 2: $L_{PSS/SSS, deact,max,}$ = 7 for Max(DRX cycle, measCycleSCell)≤40ms where DRX cycle is 0 for non-DRX, $L_{PSS/SSS, deact,max}$ = 5 for 40ms<Max(DRX cycle, measCycleSCell)≤320ms, $L_{PSS/SSS, deact,max}$ = 3 for DRX cycle>320ms. NOTE 3: Upon exceeding $L_{PSS/SSS, deact,max,}$, the UE is not required to meet the requirements for PSS/SSS detection.	

Table 9.2A.5.1-4: Time period for time index detection, deactivated SCell

Condition	$T_{SSB\_time\_index\_intra\_CCA}$
No DRX	$(3+L_{ind,deact})$ x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	$(3+L_{ind,deact})$ x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle>320ms	$(3+L_{ind,deact})$ x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: $L_{ind,deact}$ is the number of SMTC occasions not available at the UE during $T_{SSB\_time\_index\_intra\_CCA}$ for index detection, where $L_{ind,deact} < L_{ind,deact,max,}$ NOTE 2: $L_{ind,deact,max,}$ = 5 for Max(DRX cycle, measCycleSCell)≤40ms where DRX cycle is 0 for non-DRX, $L_{ind,deact,max}$ = 3 for 40ms<Max(DRX cycle, measCycleSCell)≤320ms, $L_{ind,deact,max}$ = 2 for DRX cycle>320ms. NOTE 3: Upon exceeding $L_{ind,deact,max}$ over the period of time $T_{SSB\_time\_index\_intra\_CCA}$, the UE has to restart the time index detection procedure.	

9.2A.5.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2A.5.2-1, 9.2A.5.2-2 (deactivated SCell).

If SCG DRX is in use, intra-frequency measurement period requirements specified in Table 9.2A.5.2-1, Table 9.2A.5.2-2 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

The requirements apply provided any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3.

When the time period of unsuccessful measurement attempts due to exceeding the maximum number of unavailable at the UE SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3, UE shall stop the measurement attempts on this SSB and perform the detection procedure again like for any other SSB.

Table 9.2A.5.2-1: Measurement period for intra-frequency measurements without gaps

Condition	$T_{SSB\_measurement\_period\_intra\_CCA}$
No DRX	max(200ms, ceil($(5+L_{meas})$ x K_p) x SMTC period)$^{Note\ 1}$ x $CSSF_{intra}$
DRX cycle≤ 320ms	max(200ms, ceil(1.5x $(5+L_{meas})$ x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	ceil($(5+L_{meas})$ x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified NOTE 2: L_{meas} is the number of SMTC occasions not available at the UE during $T_{SSB\_measurement\_period\_intra\_CCA}$ for measurement, where $L_{meas} < L_{meas,max}$. NOTE 3: $L_{meas,max}$ = 7 for Max(DRX cycle,SMTC period)≤40ms where DRX cycle is 0 for non-DRX, $L_{meas,max}$ = 5 for 40ms<Max(DRX cycle,SMTC period)≤320ms, $L_{meas,max}$ = 3 for DRX cycle>320ms. NOTE 4: Upon exceeding $L_{meas,max}$ over the period of time $T_{SSB\_measurement\_period\_intra\_CCA}$, the UE has to restart the measurement procedure.	

Table 9.2A.5.2-2: Measurement period for intra-frequency measurements without gaps (deactivated SCell)

Condition	$T_{SSB\_measurement\_period\_intra\_CCA}$
No DRX	$(5+L_{meas,deact})$ x measCycleSCell x $CSSF_{intra}$
DRX cycle≤ 320ms	$(5+L_{meas, deact})$ x max(measCycleSCell, 1.5xDRX cycle) x $CSSF_{intra}$
DRX cycle>320ms	$(5+L_{meas, deact})$ x max(measCycleSCell, DRX cycle) x $CSSF_{intra}$
NOTE 1: $L_{meas,deact}$ is the number of SMTC occasions not available at the UE during $T_{SSB\_measurement\_period\_intra\_CCA}$ for measurement, where $L_{meas,deact}$ <$L_{meas, ,deact ,max}$ NOTE 2: $L_{meas, ,deact ,max,}$ = 7 for Max(DRX cycle, measCycleSCell)≤40ms where DRX cycle is 0 for non-DRX, $L_{meas, ,deact ,max}$ = 5 for 40ms<Max(DRX cycle, measCycleSCell)≤320ms, $L_{meas, ,deact ,max}$ = 3 for DRX cycle>320ms. NOTE 3: Upon exceeding $L_{meas,deact,max}$ over the period of time $T_{SSB\_measurement\_period\_intra\_CCA}$, the UE has to restart the measurement procedure.	

9.2A.5.3 Scheduling availability of UE during intra-frequency measurements

UE shall be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols to be measured in the following clauses are the SSB symbols indicated by *SSB-ToMeasure* [2], if it is configured; otherwise, all *L* SSB symbols within SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

9.2A.5.3.1 Scheduling availability of UE performing measurements in TDD bands

When UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, and on 1 data symbol before each consecutive SSB symbols configured to be measured and 1 data symbol after each consecutive SSB symbols configured to be measured within SMTC window duration if *deriveSSB_IndexFromCell* is enabled. If the high layer in TS 38.331[2] signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration if *deriveSSB_IndexFromCell* is not enabled. If the high layer in TS 38.331 [2] signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.

When the UE performs intra-frequency measurements in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- The UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols configured to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB configured to be measured/RSSI symbols and 1 data symbol after each consecutive SSB configured to be measured/RSSI symbols within SMTC window duration if *deriveSSB_IndexFromCell* is enabled. If the high layer signaling of smtc2 is configured (in TS 38.331), the SMTC periodicity follows smtc2; Otherwise the SMTC periodicity follows smtc1.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on all symbols within SMTC window duration if *deriveSSB_IndexFromCell* is not enabled. If the high layer in TS 38.331 signaling of smtc2 is configured, the SMTC periodicity follows smtc2; Otherwise SMTC periodicity follows smtc1.

When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.2A.5.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If *deriveSSB_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

9.2A.6 Intra-frequency measurements with measurement gaps

9.2A.6.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra frequency cell within $T_{identify\_intra\_without\_index\_CCA}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra frequency cell within $T_{identify\_intra\_with\_index\_CCA}$. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within $T_{identify\_intra\_without\_index\ CCA}$.

$$T_{identify\_intra\_without\_index\ CCA} = T_{PSS/SSS\_sync\_intra\_CCA} + T_{SSB\_measurement\_period\_intra\_CCA}\ \ ms$$

$$T_{identify\_intra\_with\_index\_CCA} = T_{PSS/SSS\_sync\_intra\_CCA} + T_{SSB\_measurement\_period\_intra\_CCA} + T_{SSB\_time\_index\_intra\_CCA}$$

Where:

$T_{PSS/SSS\_sync\_intra\_CCA}$: it is the time period used in PSS/SSS detection given in table 9.2A.6.1-1.

$T_{SSB\_time\_index\_intra\_CCA}$: it is the time period used to acquire the index of the SSB being measured given in table 9.2A.6.1-2.

$T_{SSB\_measurement\_period\_intra\_CCA}$: equal to a measurement period of SSB based measurement given in table 9.2A.6.2-1 or 9.2A.6.1-3.$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

If SCG DRX is in use, intra-frequency cell identification requirements specified in Table 9.2A.6.1-1 and Table 9.2A.6.1-2 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

The requirements apply provided any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3.

Table 9.2A.6.1-1: Time period for PSS/SSS detection

Condition	$T_{PSS/SSS\_sync\_intra\_CCA}$
No DRX	max(600ms, (5+$L_{PSS/SSS,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(600ms, ceil(1.5x (5+$L_{PSS/SSS,gaps}$)) x max(DRX cycle, MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle>320ms	(5+$L_{PSS/SSS,gaps}$) x (MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: $L_{PSS/SSS,gaps}$ is the number of SMTC occasions not available at the UE during $T_{PSS/SSS\_sync\_intra\_CCA}$ for PSS/SSS detection, where $L_{PSS/SSS,gaps}$ <$L_{PSS/SSS,gaps,max}$.. NOTE 2: $L_{PSS/SSS,gaps,max,}$ =7 for Max(DRX cycle, SMTC period, MGRP)≤40ms where DRX cycle is 0 for non-DRX, $L_{PSS/SSS,gaps,max}$ =5 for 40ms<Max(DRX cycle, SMTC period, MGRP)≤320ms, $L_{PSS/SSS,gaps,max}$ =3 for DRX cycle>320ms. NOTE 3: Upon exceeding $L_{PSS/SSS,gaps,max}$, the UE is not required to meet the requirements for PSS/SSS detection.	

Table 9.2A.6.1-2: Time period for time index detection

Condition	$T_{SSB\_time\_index\_intra\_CCA}$
No DRX	max(120ms, (3+$L_{ind,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(120ms, ceil(1.5x (3+$L_{ind,gaps}$)) x max(MGRP, SMTC period,DRX cycle) x $CSSF_{intra}$)
DRX cycle>320ms	(3+$L_{ind,gaps}$) x (MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: $L_{ind,gaps}$ is the number of SMTC occasions not available at the UE during $T_{SSB\_time\_index\_intra\_CCA}$ for index detection where $L_{ind,gaps}$ < $L_{ind,gaps,max}$.. NOTE 2: $L_{ind,gaps,max,}$ = 5 for Max(DRX cycle, SMTC period, MGRP)≤40ms where DRX cycle is 0 for non-DRX, $L_{ind,gaps,max}$ = 3 for 40ms<Max(DRX cycle, SMTC period, MGRP)≤320ms, $L_{ind,gaps,max}$ = 2 for DRX cycle>320ms. NOTE 3: Upon exceeding $L_{ind,gaps,max}$ over the $T_{SSB\_time\_index\_intra\_CCA}$ period of time, the UE has to restart the time index detection procedure.	

9.2A.6.2 Intra-frequency Measurement Period

The measurement period for intra-frequency measurements with gaps is as shown in table 9.2A.6.2-1.

If SCG DRX is in use, intra-frequency measurement period requirements specified in Table 9.2A.6.2-1 shall depend on the SCG DRX cycle. Otherwise, the requirements for when DRX is not in use shall apply.

The requirements apply provided any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3.

When the time period of unsuccessful measurement attempts due to exceeding the maximum number of unavailable at the UE SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.2A.4.3, UE shall stop the measurement attempts on this SSB and perform the detection procedure again like for any other SSB.

Table 9.2A.6.2-1: Measurement period for intra-frequency measurements with gaps

Condition	$T_{SSB\_measurement\_period\_intra\_CCA}$
No DRX	max(200ms, (5+$L_{meas,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(200ms, ceil(1.5x (5+$L_{meas,gaps}$)) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	(5+$L_{meas,gaps}$) x (MGRP, DRX cycle) x $CSSF_{intra}$
NOTE 1: $L_{meas,gaps}$ is the number of SMTC occasions not available at the UE during $T_{SSB\_time\_index\_intra\_CCA}$ for measurement where $L_{meas,gaps}$ < $L_{meas,gaps,max}$. NOTE 2: $L_{meas,gaps,max}$ = 7 for Max(DRX cycle, SMTC period, MGRP)≤40ms where DRX cycle is 0 for non-DRX, $L_{meas,gaps,max}$ = 5 for 40ms<Max(DRX cycle, SMTC period, MGRP)≤320ms, $L_{meas,gaps,max}$ = 3 for DRX cycle>320ms. NOTE 3: Upon exceeding $L_{meas,gaps,max}$ over the $T_{SSB\_measurement\_period\_intra\_CCA}$ period of time, the UE has to restart the measurement procedure.	

9.2A.7 Intra-frequency RSSI and Channel occupancy measurements

9.2A.7.1 Intra-frequency RSSI measurements

An RSSI measurement is defined as an intra-frequency measurement provided that the RSSI measurement bandwidth is fully contained within the current carrier bandwidth of the UE.

The UE physical layer shall be capable of performing the RSSI measurements, defined in TS 38.215 [4] on one or more serving carriers operating with CCA, TS 37.213 [33], if the carrier(s) are indicated by higher layers [2], and report the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [2] occurring with a configured RSSI measurement timing configuration periodicity [2], *rmtc-Periodicity*.

The measurement period for intra-frequency RSSI measurements without measurement gaps is as shown in Table 9.2A.7.1-1 and Table 9.2A.7.1-2. The measurement period for intra-frequency RSSI measurements with measurement gaps is as shown in Table 9.2A.7.1-3.

Table 9.2A.7.1-1: Measurement period for intra-frequency RSSI measurements without measurement gaps when SMTC and RMTC are overlapping

Condition NOTE1,2	$T_{RSSI\_measurement\_period\_intra\_cca}$
No DRX	max(*reportInterval*, *rmtc-Periodicity**$CSSF_{outside\_gap,i}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, DRX cycle) *$CSSF_{outside\_gap,i}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{outside\_gap,\ i}$ is a carrier specific scaling factor and is determined according to $CSSF_{outside\_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gap.	

Table 9.2A.7.1-2: Measurement period for intra-frequency RSSI measurements without measurement gaps when SMTC and RMTC are not overlapping

Condition NOTE1,2	$T_{RSSI\_measurement\_period\_intra\_cca}$
No DRX	max(*reportInt*erval, $N_{intra\text{-}MO}$**rmtc-Periodicity*)
DRX	max(*reportInt*erval, $N_{intra\text{-}MO}$*max(*rmtc-Periodicity*, DRXcycle length))
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $N_{intra\text{-}MO}$ is defined as the number of measurement objects that can be measured without gaps	

Table 9.2A.7.1-3: Measurement period for intra-frequency RSSI measurements with measurement gaps

Condition NOTE1,2	$T_{RSSI\_measurement\_period\_intra\_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{intra}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle length) x $CSSF_{intra}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{intra}$ is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

If the UE requires measurement gaps to perform intra-frequency measurements, a single measurement gap pattern is used for all concurrent intra-frequency measurements, including intra-frequency RSSI measurements. The RSSI measurement duration and the measurement gap should be aligned, and the following additional condition should be fulfilled:

- Entire RSSI measurement duration should be contained in the measurement gap.

The RSSI measurement performed and reported according to this clause shall meet the RSSI measurement accuracy requirement in Clause 10.1.34.1. The reported RSSI measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in Clause 10.1.34.3.

9.2A.7.2 Intra-frequency Channel occupancy measurements

The UE shall be capable of estimating the channel occupancy on one or more serving carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer.

The measurement period for intra-frequency channel occupancy measurements without measurement gap is as shown in Table 9.2A.7.2-1 and Table 9.2A.7.1-2. The measurement period for intra-frequency RSSI measurements with measurement gaps is as shown in Table 9.2A.7.2-3.

Table 9.2A.7.2-1: Measurement period for intra-frequency Channel Occupancy measurements without measurement gaps when SMTC and RMTC are overlapping

Condition NOTE1,2	$T_{RSSI\_measurement\_period\_intra\_cca}$
No DRX	max(*reportInterval*, *rmtc-Periodicity**$CSSF_{outside\_gap,i}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, DRX cycle) *$CSSF_{outside\_gap,i}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{outside\_gap, i}$ is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gap.	

Table 9.2A.7.2-2: Measurement period for intra-frequency Channel Occupancy measurements without measurement gaps when SMTC and RMTC are not overlapping

Condition NOTE1,2	$T_{RSSI\_measurement\_period\_intra\_cca}$
No DRX	max(*reportInt*erval, $N_{intra-MO}$**rmtc-Periodicity*)
DRX	max(*reportInt*erval, $N_{intra-MO}$*max(*rmtc-Periodicity*, DRXcycle length))
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $N_{intra-MO}$ is defined as the number of measurement objects that can be measured without gaps	

Table 9.2A.7.2-3: Measurement period for intra-frequency RSSI measurements with measurement gaps

Condition NOTE1,2	$T_{RSSI\_measurement\_period\_intra\_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{intra}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle length) x $CSSF_{intra}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{intra}$ is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

If the UE requires measurement gaps to perform intra-frequency measurements, a single measurement gap pattern is used for all concurrent intra-frequency measurements, including intra-frequency RSSI measurements. The RSSI measurement duration and the measurement gap should be aligned, and the following additional condition should be fulfilled:

- Entire RSSI measurement duration should be contained in the measurement gap.

The channel occupancy measurement performed and reported according to this clause shall meet the channel occupancy measurement accuracy requirements in Clause 10.1.35.1. The reported channel occupancy measurement values contained in measurement reports shall be based on the measurement reporting range specified in TS 38.331 [2].

9.2A.7.3 Scheduling restriction during RSSI and Channel Occupancy measurements

When the UE performs intra-frequency RSSI/CO measurements in unlicensed spectrum, the following restrictions apply due to RSSI/CO measurements:

- The UE is not expected to transmit PUCCH/PUSCH/SRS on RSSI measurement symbols configured by RMTC.

When intra-band carrier aggregation in unlicensed spectrum is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with the aforementioned restricted symbols.

9.3 NR inter-frequency measurements

9.3.1 Introduction

A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2.

The UE shall be able to identify new inter-frequency cells and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by PCell or PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

The UE can perform inter-frequency SSB based measurements without measurement gaps if

- the UE supports interFrequencyMeas-Nogap-r16 [15], and
- interFrequencyConfig-NoGap-r16 [15] is indicated, and
- the SSB is completely contained in the active BWP of the UE.

For inter-frequency SSB based measurements without measurement gaps, UE may cause scheduling restriction as specified in clause 9.3.5.3.

SSB based measurements are configured along with a measurement timing configuration (SMTC) per carrier, which provides periodicity, duration and offset information on a window of up to 5ms where the measurements on the configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, one measurement window periodicity may be configured per inter-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB which ends later than the gap end – switching time. When the inter-frequency cells are in FR2 and the per-FR gap is configured to the UE in EN-DC, SA NR, NE-DC and NR-DC, or the serving cells are in FR2, the inter-frequency cells are in FR2 and the per-UE gap is configured to the UE in SA NR and NR-DC, the switching time is 0.25ms. Otherwise the switching time is 0.5ms.

The requirements in this clause shall also apply, when the UE is configured to perform SRS carrier based switching and using measurement gaps.

Longer measurement period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

9.3.2 Requirements applicability

The requirements in clause 9.3 apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clauses 10.1.4 and 10.1.5 for FR1 and FR2, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in clauses 10.1.9 and 10.1.10 for FR1 and FR2, respectively, for a corresponding Band,
- SS-SINR related side conditions given in clauses 10.1.14 and 10.1.15 for FR1 and FR2, respectively, for a corresponding Band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding Band.

9.3.2.1 Void

9.3.2.2 Void

9.3.3 Number of cells and number of SSB

9.3.3.1 Requirements for FR1

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and

- 7 SSBs with different SSB index and/or PCI on the inter-frequency layer.

9.3.3.2 Requirements for FR2

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 10 SSBs with different SSB index and/or PCI on the inter-frequency layer, and
- 1 SSB per identified cell.

9.3.4 Inter-frequency measurement with measurement gaps

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter frequency cell within $T_{identify\_inter\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter frequency cell within $T_{identify\_inter\_with\_index}$. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within $T_{identify\_inter\_without\_index}$.

$$T_{identify\_inter\_without\_index} = (T_{PSS/SSS\_sync\_inter} + T_{SSB\_measurement\_period\_inter}) \text{ ms}$$

$$T_{identify\_inter\_with\_index} = (T_{PSS/SSS\_sync\_inter} + T_{SSB\_measurement\_period\_inter} + T_{SSB\_time\_index\_inter}) \text{ ms}$$

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3.4-1 and table 9.3.4-2.

$T_{SSB\_time\_index\_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3.4-3 and table 9.3.4-4.

$T_{SSB\_measurement\_period\_inter}$: equal to a measurement period of SSB based measurement given in table 9.3.5-1 and table 9.3.5-2.

M_{pss/sss_sync_inter}: For a UE supporting FR2 power class 1, M_{pss/sss_sync_inter} = 64 samples. For a UE supporting FR2 power class 2, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2 power class 3, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2 power class 4, M_{pss/sss_sync_inter} = 40 samples.

$M_{SSB\_index\_inter}$: For a UE supporting FR2 power class 1, $M_{SSB\_index\_inter}$ = 40 samples. For a UE supporting FR2 power class 2, $M_{SSB\_index\_inter}$ = 24 samples. For a UE supporting FR2 power class 3, $M_{SSB\_index\_inter}$ = 24 samples. For a UE supporting FR2 power class 4, $M_{SSB\_index\_inter}$ = 24 samples.

$M_{meas\_period\_inter}$: For a UE supporting FR2 power class 1, $M_{meas\_period\_inter}$ =64 samples. For a UE supporting FR2 power class 2, $M_{meas\_period\_inter}$=40 samples. For a UE supporting FR2 power class 3, $M_{meas\_period\_inter}$ =40 samples. For a UE supporting FR2 power class 4, $M_{meas\_period\_inter}$ = 40 samples.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

Table 9.3.4-1: Time period for PSS/SSS detection (Frequency range FR1)

Condition NOTE1,2	T_{PSS/SSS_sync_inter}
No DRX	Max(600ms, 8 × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320ms	Max(600ms, Ceil(8*1.5) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320ms	8 × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.3.4-2: Time period for PSS/SSS detection, (Frequency range FR2)

Condition NOTE1,2	T_{PSS/SSS_sync_inter}
No DRX	Max(600ms, M_{pss/sss_sync_inter} × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320ms	Max(600ms, (1.5 × M_{pss/sss_sync_inter}) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320ms	M_{pss/sss_sync_inter} × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.3.4-3: Time period for time index detection (Frequency range FR1)

Condition NOTE1,2	$T_{SSB\_time\_index\_inter}$
No DRX	Max(120ms, 3 × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320ms	Max(120ms, Ceil(3 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320ms	3 × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.3.4-4: Time period for time index detection (Frequency range FR2)

Condition NOTE1,2	$T_{SSB\_time\_index\_inter}$
No DRX	Max(200ms, $M_{SSB\_index\_inter}$ × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320ms	Max(200ms, (1.5 × $M_{SSB\_index\_inter}$) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320ms	$M_{SSB\_index\_inter}$ × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

9.3.4.1 Void

9.3.4.2 Void

9.3.5 Inter-frequency measurements

When measurement gaps are provided for inter frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.5-1 and 9.3.5-2:

Table 9.3.5-1: Measurement period for inter-frequency measurements with gaps (Frequency FR1)

Condition NOTE1,2	$T_{SSB\_measurement\_period\_inter}$
No DRX	Max(200ms, 8 × Max(MGRP, SMTC period)) × $CSSF_{inter}$
DRX cycle ≤ 320ms	Max(200ms, Ceil(8 × 1.5) × Max(MGRP, SMTC period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320ms	8 × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.3.5-2: Measurement period for inter-frequency measurements with gaps (Frequency FR2)

Condition NOTE1,2	$T_{SSB\_measurement\_period\_inter}$
No DRX	Max(400ms, $M_{meas\_period\_inter} \times$ Max(MGRP, SMTC period)) $\times$ $CSSF_{inter}$
DRX cycle ≤ 320ms	Max(400ms, (1.5 $\times$ $M_{meas\_period\_inter}$) $\times$ Max(MGRP, SMTC period, DRX cycle)) $\times$ $CSSF_{inter}$
DRX cycle > 320ms	$M_{meas\_period\_inter} \times$ DRX cycle $\times$ $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

9.3.5.1 Void

9.3.5.2 Void

9.3.5.3 Void

9.3.6 Inter-frequency measurements reporting requirements

9.3.6.1 Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

9.3.6.2 Event-triggered Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3.6.3.

9.3.6.3 Event-triggered Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.4.1, 10.1.5.1, 10.1.9.1, 10.1.10.1, 10.1.14.1 and 10.1.15.1, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within $T_{identify\_inter\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter frequency cell within $T_{identify\_inter\_with\_index}$. Both $T_{identify\_inter\_without\_index}$ and $T_{identify\_inter\_with\_index}$ are defined in clause 9.3.4. When L3 filtering is used an additional delay can be expected. In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or in both FR1 and FR2 if the UE is not capable of per-FR gap.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify\_inter\_without\_index}$ or $T_{identify\_inter\_with\_index}$ defined in clause 9.3.4. If a cell which has been detectable at least for the time period $T_{identify\_inter\_without\_index}$ or $T_{identify\_inter\_with\_index}$ defined in clause 9.3.4 becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again with the same spatial reception parameter and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than

$T_{SSB\_measurement\_period\_inter}$ defined in clause 9.3.5 provided the timing to that cell has not changed more than ± 3200 Tc while measurement gap has not been available and the L3 filtering has not been used. When L3 filtering is used an additional delay can be expected. In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or in both FR1 and FR2 if the UE is not capable of per-FR gap.

9.3.7 Void

9.3.8 Inter-frequency SFTD measurement requirements

9.3.8.1 Introduction

This clause contains requirements for a UE supporting NR inter-frequency SFTD measurement and is applicable in RRC_CONNECTED state. The UE shall, depending on network request, perform inter-frequency SFTD measurement and report SFTD result with or without SS-RSRP. The overall delay includes RRC procedure delay defined in clause 12 in TS 38.331 [2] and SFTD measurement reporting delay in clause 9.3.8.3.

UE which fulfils the requirements in clause 9.3.8 is not supposed to fulfil the requirements defined in clause 9.2.5.4.

9.3.8.2 SFTD Measurement delay

The requirements on SFTD measurement delay defined in this clause are applicable under the side condition SCH Ês/Iot ⩾ -3 dB for the inter-frequency neighbour cell. Depending on configuration, the SFTD measurement may be carried out with or without the support of configured measurement gaps. In the current release, indication on whether to carry out the SFTD measurement with or without measurement gaps is implicit and depending on whether measurement gaps are configured.

The UE shall be able to detect, identify and measure SFTD of up to 3 of the strongest applicable inter-frequency neighbour cells on the carrier frequency provided in the SFTD measurement configuration. Further depending on the SFTD measurement configuration, the UE shall additionally report SS-RSRP for the one or more strongest cells. The UE may or may not be configured with *cellsForWhichToReportSFTD*. The UE does not expect *cellsForWhichToReportSFTD* to change during an ongoing SFTD measurement.

When no measurement gaps are provided, the UE shall be capable of finding the inter-frequency neighbour cell regardless of its SSB position in the SMTC period, provided that the carrier frequency where SFTD measurement is configured and the serving carrier(s) form a supported CA or NR-DC band combination of the UE. The SFTD measurement shall be conducted with sustained connection to the PCell and activated SCell(s) in MCG. Depending on capability, the UE may be allowed to cause a certain amount of interruptions for reconfiguration of the radio receiver, as specified in clause 8.2.2.2.6.

When measurement gaps are provided, the UE shall be capable of finding the inter-frequency neighbour cell under the additional condition that the SSB at least occasionally falls within the measurement gap.

When no DRX is used, the UE shall be capable of determining SFTD within a physical layer measurement period of $T_{measure\_SFTD1}$ as follows:

- For SFTD measurements without measurement gaps, and without additional SS-RSRP reporting:
  - For carrier frequency in FR1: $T_{measure\_SFTD1}$ = 14 SMTC periods
  - For carrier frequency in FR2: $T_{measure\_SFTD1}$ = 112 SMTC periods
- For SFTD measurements in measurement gaps, and without additional SS-RSRP reporting:
  - For carrier frequency in FR1: $T_{measure\_SFTD1} = CSSF_{inter} \times 8 \times$ Max(MGRP, SMTC period)
  - For carrier frequency in FR2: $T_{measure\_SFTD1} = CSSF_{inter} \times 64 \times$ Max(MGRP, SMTC period))
- For SFTD measurements without measurement gaps, and with additional SS-RSRP reporting:
  - For carrier frequency in FR1: $T_{measure\_SFTD1}$ = 19 SMTC periods

  - For carrier frequency in FR2: $T_{measure\_SFTD1}$ = 152 SMTC periods

- For SFTD measurements in measurement gaps, and with additional SS-RSRP reporting:

  - For carrier frequency in FR1: $T_{measure\_SFTD1} = CSSF_{inter} \times 13 \times Max(MGRP, SMTC period)$

  - For carrier frequency in FR2: $T_{measure\_SFTD1} = CSSF_{inter} \times 104 \times Max(MGRP, SMTC period)$

where $CSSF_{inter}$ is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

When DRX is used, the same $T_{measure\_SFTD1}$ as for non-DRX applies, but the reporting delay depends on the DRX cycle length in use.

In case PCell is changed due to handover, the UE shall terminate the inter-frequency SFTD measurement.

The measurement accuracy for the SFTD measurement shall fulfil the requirement in clause 10.1.21.3. The measurement accuracy for additionally reported SS-RSRP shall fulfil the requirement in clauses 10.1.4.1 and 10.1.5.1 for neighbour cell in FR1 and FR2, respectively.

9.3.8.3 SFTD Measurement reporting delay

The SFTD measurement reporting delay is defined as the time between a command that will trigger an SFTD measurement report and the point when the UE starts to transmit the measurement report over the air interface, excluding the RRC procedure delay defined in TS 38.331 [2]. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of 2 $\times$ TTI_{DCCH} resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The SFTD measurement reporting delay shall be less than $T_{measure\_SFTD1}$ defined in clause 9.3.8.2.

9.3.9 Inter frequency measurements without measurement gaps

9.3.9.1 Inter frequency Cell identification

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE shall be able to identify a new detectable inter frequency cell within $T_{identify\_inter\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter frequency cell within $T_{identify\_inter\_with\_index}$. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within $T_{identify\_inter\_without\_index}$. It is assumed that when UE performs inter-frequency measurements without measurement gaps in a TDD bands on FR1 and FR2, the following conditions are met:

- SFN and frame boundary across serving cell and inter-frequency neighbor cells is aligned, and

- the timing of SSBs across serving cell and inter-frequency neighbor cells are aligned$T_{identify_inter_without_index} = (T_{PSS/SSS_sync_inter} + T_{SSB_measurement_period_inter})$ ms

$$T_{identify\_inter\_with\_index} = (T_{PSS/SSS\_sync\_inter} + T_{SSB\_measurement\_period\_inter} + T_{SSB\_time\_index\_inter}) \text{ ms}$$

Where:

T_{PSS/SSS_sync_inter}: it is the time period used in PSS/SSS detection given in table 9.3.4-1 and table 9.3.4-2.

$T_{SSB\_time\_index\_inter}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3.4-3.

$T_{SSB\_measurement\_period\_inter}$: equal to a measurement period of SSB based measurement given in table 9.3.9-1 and table 9.3.9-2.

$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside\_gap,i}$ in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when interfrequency SMTC is fully non overlapping or partially overlapping with measurement gaps or according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when interfrequency SMTC is fully overlapping with measurement gaps.

M_{pss/sss_sync_inter}: For a UE supporting FR2 power class 1, M_{pss/sss_sync_inter} = 40 samples. For a UE supporting FR2 power class 2, M_{pss/sss_sync_inter} = 24 samples. For a UE supporting FR2 power class 3, M_{pss/sss_sync_inter} = 24 samples. For a UE supporting FR2 power class 4, M_{pss/sss_sync} = 24 samples.

$M_{SSB\_index\_inter}$: For a UE supporting power class 1, $M_{SSB\_index\_inter}$ = 40 samples. For a vehicle mounted UE supporting power class 2, M_{pss/sss_sync_inter} = 24 samples. For a UE supporting power class 3, $M_{SSB\_index\_inter}$ = 24 samples. For a UE supporting power class 4, $M_{meas\_period\_inter}$ = 24 samples.

$M_{meas\_period\_inter}$: For a UE supporting FR2 power class 1, $M_{meas\_period\_inter}$ =40 samples. For a vehicle mounted UE supporting FR2 power class 2, M_{pss/sss_sync_inter}=24 samples. For a UE supporting FR2 power class 3, $M_{meas\_period\_inter}$ =24 samples. For a UE supporting FR2 power class 4, $M_{meas\_period\_inter}$ = 24 samples.

When interfrequency SMTC is fully non overlapping with measurement gaps or interfrequency SMTC is fully overlapping with MGs, Kp=1.

When interfrequency SMTC is partially overlapping with measurement gaps, Kp = 1/(1- (SMTC period /MGRP)), where SMTC period < MGRP.

For FR2,

$K_{layer1\_measurement}$=1,

- if all of the reference signals configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap are not fully overlapped by intra-frequency SMTC occasions, or
- if all of the reference signal configured for RLM, BFD, CBD or L1-RSRP for beam reporting on any FR2 serving frequency in the same band outside measurement gap and fully-overlapped by intra-frequency SMTC occasions are not overlapped with any of the SSB symbols and the RSSI symbols, and 1 symbol before each consecutive SSB symbols and the RSSI symbols, and 1 symbol after each consecutive SSB symbols and the RSSI symbols, given that *SSB-ToMeasure* and *SS-RSSI-Measurement* are configured, where SSB symbols are indicated by *SSB-ToMeasure* and RSSI symbols are indicated by *SS-RSSI-Measurement*;

$K_{layer1\_measurement}$=1.5, otherwise.

If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

Table 9.3.4-1: Time period for PSS/SSS detection, (FR1)

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600ms, ceil(5 x K_p) x SMTC period)$^{Note\ 1}$ x $CSSF_{inter}$
DRX cycle≤ 320ms	max(600ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320ms	ceil(5 x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3.4-2: Time period for PSS/SSS detection, (FR2)

DRX cycle	T_{PSS/SSS_sync_inter}
No DRX	max(600ms, ceil(M_{pss/sss_sync_inter} x K_p x $K_{layer1\_measurement}$) x SMTC period)$^{Note\ 1}$ x $CSSF_{inter}$
DRX cycle≤ 320ms	max(600ms, ceil(1.5 x M_{pss/sss_sync_inter} x K_p x $K_{layer1\_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320ms	ceil(M_{pss/sss_sync_inter} x K_p x $K_{layer1\_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3.4-3: Time period for time index detection (FR1)

DRX cycle	$T_{SSB\_time\_index\_intra}$
No DRX	max(120ms, ceil(3 x K_p) x SMTC period)$^{Note 1}$ x $CSSF_{inter}$
DRX cycle≤ 320ms	max(120ms, ceil (1.5 x 3 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320ms	Ceil(3 x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

9.3.9.2 Measurement period

The UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.4, 10.1.5, 10.1.9, 10.1.10, 10.1.14 and 10.1.15, respectively, as shown in table 9.3.9-1 and 9.3.9-2, if UE supports inter-frequency measurement without measurement gaps:

Table 9.3.9-1: Measurement period for inter-frequency measurements with gaps ((FR1)

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX	max(200ms, ceil(5 x K_p) x SMTC period)$^{Note 1}$ x $CSSF_{inter}$
DRX cycle≤ 320ms	max(200ms, ceil(1.5x 5 x K_p) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320ms	ceil(5 x K_p) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 9.3.9-2: Measurement period for inter-frequency measurements with gaps (FR2)

DRX cycle	$T_{SSB\_measurement\_period\_intra}$
No DRX	max(400ms, ceil($M_{meas\_period\_inter}$ x K_p x $K_{layer1\_measurement}$) x SMTC period)$^{Note 1}$ x $CSSF_{inter}$
DRX cycle≤ 320ms	max(400ms, ceil(1.5x $M_{meas\_period\_inter}$ x K_p x $K_{layer1\_measurement}$) x max(SMTC period,DRX cycle)) x $CSSF_{inter}$
DRX cycle>320ms	ceil($M_{meas\_period\_inter}$ xK_p x $K_{layer1\_measurement}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

9.3.9.3 Scheduling availability of UE during inter-frequency measurements

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE is required to be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols to be measured in the following clauses are the SSB symbols indicated by SSB-ToMeasure [2], if it is configured; otherwise, all L SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included.

The scheduling availability requirements when UE performs inter-frequency measurements without measurement gaps in a TDD bands on FR1 and FR2 in clause 9.3.9.3.1~9.3.9.3.3 are valid under the following conditions:

- SFN and frame boundary across serving cell and inter-frequency neighbor cells is aligned, and
- the timing of SSBs across serving cell and inter-frequency neighbor cells are aligned

9.3.9.3.1 Scheduling availability of UE performing measurements in TDD bands on FR1

When UE performs inter-frequency measurements without measurement gaps in a TDD band, the following restrictions apply due to SS-RSRP or SS-SINR measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

When UE performs inter-frequency measurements without measurement gaps in a TDD band, the following restrictions apply due to SS-RSRQ measurement

- UE is not expected to transmit PUCCH/PUSCH/SRS on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

When TDD intra-band carrier aggregation is performed, the scheduling restrictions due to one serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

9.3.9.3.2 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UE which do not support *simultaneousRxDataSSB-DiffNumerology-Inter-r16* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If UE performs inter-frequency measurements without measurement gaps in a TDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If UE performs inter-frequency measurements without measurement gaps in a FDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

9.3.9.3.3 Scheduling availability of UE performing measurements on FR2

The following scheduling restriction applies due to SS-RSRP or SS-SINR measurement on an FR2 inter-frequency cell

The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

The following scheduling restriction applies to SS-RSRQ measurement on an FR2 inter-frequency cell

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, RSSI measurement symbols, and on 1 data symbol before each consecutive SSB to be measured/RSSI symbols and 1 data symbol after each consecutive SSB to be measured/RSSI symbols within SMTC window duration.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell should also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

If following conditions are met:

- The UE has been notified about system information update through paging,

- The gap between the UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, the UE is expected to receive the PDCCH that the UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, the UE is expected to receive PDSCH that corresponds to the PDCCH that the UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured.

9.3.9.3.4 Scheduling availability of UE performing measurements on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to measurements performed on FR2 serving cell frequency layer.

There are no scheduling restrictions on FR2 serving cell(s) due to measurements performed on FR1 serving cell frequency layer.

9.3A NR inter-frequency measurements in carrier frequencies with CCA

9.3A.1 Introduction

The requirements in clause 9.3A apply for inter-frequency measurements on a carrier frequency with CCA. A measurement is defined as an SSB based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.2A.The UE shall be able to identify new inter-frequency cells in carrier frequencies with CCA and perform SS-RSRP, SS-RSRQ, and SS-SINR measurements of identified inter-frequency cells if carrier frequency information is provided by PCell or PSCell, even if no explicit neighbour list with physical layer cell identities is provided.

SSB based measurements are configured along with a measurement timing configuration (SMTC) per carrier, which provides periodicity, duration and offset information on a window of up to 5ms where the measurements on the configured inter-frequency carrier are to be performed. For inter-frequency connected mode measurements, one measurement window periodicity may be configured per inter-frequency measurement object.

When measurement gaps are needed, the UE is not expected to detect SSB on an inter-frequency measurement object which start earlier than the gap starting time + switching time, nor detect SSB which end later than the gap end – switching time.

In the requirements of clause 9.3A, the term SMTC occasion not available at the UE refers to when the SMTC contains SSBs configured by gNB in a cell on a carrier frequency subject to CCA, but *N* candidate SSB positions for the same SS/PBCH block index within the discovery burst transmission window are not available at the UE due to DL CCA failures at gNB during the corresponding evaluation or measurement period, where:

- For the cell detection procedure: *N* is at least one candidate SSB position (NOTE: the one candidate SSB position for the cell detection shall not be impacted by the set of candidate SSB positions which are already being measured by the UE within the current measurement period of the on-going measurements), and
- For other procedures in clause 9.3A: *N* are the first two successive candidate SSB positions when two or more candidate SSB positions are configured for this SSB index in one discovery burst transmission window, otherwise N is one candidate SSB position;

otherwise the SMTC occasion is considered as available at the UE.

9.3A.2 Requirements applicability

The requirements in clause 9.3A apply, provided:

- The cell being identified or measured is detectable.

An inter-frequency CCA cell shall be considered detectable when for each relevant SSB:

- SS-RSRP related side conditions given in clause 10.1.28,
- SS-RSRQ related side conditions given in clause 10.1.30,
- SS-SINR related side conditions given in clause 10.1.32,

- SSB_RP and SSB Ês/Iot according to Annex B.2.9.

9.3A.3 Number of cells and number of SSB

9.3A.3.1 Requirements

For each inter-frequency layer, during each layer 1 measurement period, the UE shall be capable of performing SS-RSRP, SS-RSRQ, and SS-SINR measurements for at least:

- 4 identified cells, and
- 7 SSBs with different SSB indexes and/or PCI on the inter-frequency layer.

9.3A.4 Inter-frequency cell identification

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-frequency cell within $T_{identify\_inter\_cca\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell, in carrier frequencies with CCA, within $T_{identify\_inter\_cca\_with\_index}$. The UE shall be able to identify a new detectable inter-frequency SS block, in carrier frequencies with CCA, of an already detected cell within $T_{identify\_inter\_cca\_without\_index}$.

$$T_{identify\_inter\_cca\_without\_index} = (T_{PSS/SSS\_sync\_inter\_cca} + T_{SSB\_measurement\_period\_inter\_cca})\ ms$$

$$T_{identify\_inter\_cca\_with\_index} = (T_{PSS/SSS\_sync\_inter\_cca} + T_{SSB\_measurement\_period\_inter\_cca} + T_{SSB\_time\_index\_inter\_cca})\ ms$$

Where:

$T_{PSS/SSS\_sync\_inter\_cca}$: it is the time period used in PSS/SSS detection given in table 9.3A.4-1.

$T_{SSB\_time\_index\_inter\_cca}$: it is the time period used to acquire the index of the SSB being measured given in table 9.3A.4-2.

$T_{SSB\_measurement\_period\_inter\_cca}$: equal to a measurement period of SSB based measurement given in table 9.3A.5-1.
$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.

Table 9.3A.4-1: Time period for PSS/SSS detection

Condition NOTE1,2,3,4	$T_{PSS/SSS\_sync\_inter\_cca}$
No DRX	max(600ms, (8+$L_{PSS/SSS,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{inter}$
DRX cycle ≤ 320ms	max(600ms, ceil((8+$L_{PSS/SSS,gaps}$)x1.5) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle > 320ms	(8+$L_{PSS/SSS,gaps}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: $L_{PSS/SSS,gaps}$ is the number of SMTC occasions not available at the UE during $\mathbf{T_{PSS/SSS\_sync\_inter\_cca}}$, for PSS/SSS detection, where $L_{PSS/SSS,gaps} \le L_{PSS/SSS,gaps,max}$. NOTE 4: $L_{PSS/SSS,gaps}$ = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms $L_{PSS/SSS,gaps}$ = 8 for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and $L_{PSS/SSS,gaps}$ = 5 for DRX cycle > 320 ms.	

Upon exceeding $L_{PSS/SSS,gaps,max}$, the UE is not required to meet the corresponding PSS/SSS detection requirement. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

Table 9.3A.4-2: Time period for time index detection

Condition NOTE1,2,3,4	$T_{SSB\_time\_index\_inter\_cca}$
No DRX	max(120ms, (3+ $L_{ind,gaps}$) x max(MGRP, SMTC period)) x $CSSF_{inter}$
DRX cycle ≤ 320ms	max(120ms, ceil((3+ $L_{ind,gaps}$) x 1.5) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle > 320ms	(3 + $L_{ind,gaps}$) x DRX cycle x $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: $L_{ind,gaps}$ is the number of SMTC occasions not available at the UE during $T_{SSB\_time\_index\_inter\_cca}$, for for time index identification, where $L_{ind,gaps} \le L_{ind,gaps,max}$ NOTE 4: $L_{ind,gaps,max}$ = 5 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, $L_{ind,gaps,max}$ = 3 for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and $L_{ind,gaps,max}$ = 2 for DRX cycle > 320 ms.	

The UE shall restart the time index detection upon exceeding $L_{ind,gaps,max}$. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

9.3A.5 Inter-frequency measurements

When measurement gaps are provided for inter-frequency measurements in carrier frequencies with CCA, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.28, 10.1.30, 10.1.32, respectively, as shown in table 9.3A.5-1:

Table 9.3A.5-1: Measurement period for inter-frequency measurements with gaps

Condition NOTE1,2,3,4	$T_{SSB\_measurement\_period\_inter\_cca}$
No DRX	max(200ms, (8+ L_{meas}) x max(MGRP, SMTC period)) x $CSSF_{inter}$
DRX cycle ≤ 320ms	max(200ms, ceil((8+ L_{meas}) x 1.5) x max(MGRP, SMTC period, DRX cycle)) x $CSSF_{inter}$
DRX cycle > 320ms	(8+ L_{meas}) x DRX cycle x $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group. NOTE 3: L_{meas} is the number of SMTC occasions not available at the UE during $T_{SSB\_measurement\_period\_NR\_cca}$, for inter-frequency measurements with gaps, where $L_{meas} \le L_{meas,max}$ NOTE 4: $L_{meas,max}$ = 12 for max(DRX cycle, SMTC period, MGRP) ≤ 40 ms, $L_{meas,max}$ = 8 for 40 ms < max(DRX cycle, SMTC period, MGRP) ≤ 320 ms, and $L_{meas,max}$ = 5 for DRX cycle > 320 ms.	

The UE shall restart the measurement upon exceeding $L_{meas,max}$. The requirements apply provided that any two closest SMTC occasions available at the UE for the measurement shall be separated by no more than the maximum time requirement for the cell to remain known.

When the time period of unsuccessful measurement attemps due to exceeding the maximum number of unavailable at the UE SMTC occasions of an already identified cell exceeds the maximum time requirement for the cell to remain known defined in clause 9.3A.6.3, the UE shall stop the measurement attempts on this SSB and perform the detection procedure again, like for any other SSB.

9.3A.6 NR Inter-frequency measurements reporting requirements

9.3A.6.1 Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.28, 10.1.30, and 10.1.32, respectively.

9.3A.6.2 Event-triggered Periodic Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered periodic measurement reports shall meet the requirements in clauses 10.1.28, 10.1.30, and 10.1.32, respectively.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.3A.6.3.

9.3A.6.3 Event-triggered Reporting

Reported SS-RSRP, SS-RSRQ, and SS-SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.28, 10.1.30, and 10.1.32, respectively.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report, and all delays due to UL CCA failures until the successful transmission of the report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within $T_{identify\_inter\_cca\_without\_index}$ if UE is not indicated to report SSB based RRM measurement result with the associated SSB index. Otherwise UE shall be able to identify a new detectable inter-frequency cell within $T_{identify\_inter\_cca\ \_with\_index}$. Both $T_{identify\_inter\_cca\ \_without\_index}$ and $T_{identify\_inter\_cca\ \_with\_index}$ are defined in clause 9.3A.4. When L3 filtering is used an additional delay can be expected.

A cell is detectable only if at least one SSB measured from the cell being configured remains detectable during the time period $T_{identify\_inter\_cca\ \_without\_index}$ or $T_{identify\_inter\_cca\ \_with\_index}$ defined in clause 9.3A.4. If a cell which has been detectable at least for the time period $T_{identify\_inter\_cca\ \_without\_index}$ or $T_{identify\_inter\_cca\ \_with\_index}$ defined in clause 9.3A.4 becomes undetectable for a period $\leqslant$ 8 seconds and then the cell becomes detectable again with the same spatial reception parameter and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{SSB\_measurement\_period\_inter\_cca}$ defined in clause 9.3A.5 provided the timing to that cell has not changed more than ± 3200 Tc while measurement gap has not been available and the L3 filtering has not been used. When L3 filtering is used an additional delay can be expected.

9.3A.8 Inter-frequency RSSI measurements

An RSSI measurement is defined as an inter-frequency measurement provided that the RSSI measurement bandwidth is not contained within the current carrier bandwidth of the UE.

The UE physical layer shall be capable of performing the RSSI measurements, defined in TS 38.215 [4] on one or more inter-frequency carriers operating with CCA, TS 37.213 [33], if the carrier(s) are indicated by higher layers [2], and report the RSSI measurements to higher layers. The UE physical layer shall provide to higher layers a single RSSI sample for each OFDM symbol within each configured RSSI measurement duration [2] occurring with a configured RSSI measurement timing configuration periodicity [2], *rmtc-Periodicity*.

Table 9.3A.8-1: Measurement period for inter-frequency RSSI measurements with gaps

Condition NOTE1,2,3,4	$T_{RSSI\_measurement\_period\_inter\_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{inter}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x $CSSF_{inter}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{inter}$ is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency RSSI measurements. The RSSI measurement duration and the measurement gap should be aligned, and the following additional condition should be fulfilled:

- Entire RSSI measurement duration should be contained in the measurement gap.

The RSSI measurement performed and reported according to this clause shall meet the RSSI measurement accuracy requirement in Clause 10.1.34.2. The reported RSSI measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in Clause 10.1.34.3.

9.3A.9 Inter-frequency channel occupancy measurements

The UE shall be capable of estimating the channel occupancy on one or more carrier frequencies indicated by higher layers [2], based on RSSI samples provided by the physical layer.

Table 9.3A.9-1: Measurement period for inter-frequency Channel Occupancy measurements with gaps

Condition NOTE1,2,3,4	$T_{CO\_measurement\_period\_inter\_cca}$
No DRX	max(*reportInterval*, max(*rmtc-Periodicity, MGRP*) x $CSSF_{inter}$)
DRX	max(*reportInterval*, max(*rmtc-Periodicity*, MGRP,DRX cycle) x $CSSF_{inter}$)
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: $CSSF_{inter}$ is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5.2 for measurement conducted within measurement gaps.	

If the UE requires measurement gaps to perform inter-frequency measurements, a single measurement gap pattern is used for all concurrent inter-frequency measurements, including inter-frequency channel occupancy measurements. The RSSI measurement duration used for channel occupancy measurement and the measurement gap should be aligned, and the following additional condition should be fulfilled:

- Entire RSSI measurement duration should be contained in the measurement gap.

The channel occupancy measurement performed and reported according to this clause shall meet the channel occupancy measurement accuracy requirements in Clause 10.1.35.2. The reported channel occupancy measurement values contained in measurement reports shall be based on the measurement reporting range specified in TS 38.331 [2].

9.4 Inter-RAT measurements

9.4.1 Introduction

The requirements in this clause are specified for NR−E-UTRAN FDD and NR−E-UTRAN TDD measurements and are applicable without an explicit E-UTRAN neighbour cell list containing physical layer cell identities, for a UE:

- in RRC_CONNECTED state, and
- configured
  - with SA or NR-DC operation mode or configured in NE-DC operation mode by PCell with NR–E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR, RSTD, or E-CID) on E-UTRA non-serving frequency carrier, or
  - with SA operation mode on NR carrier frequencies with CCA by PCell with NR–E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR) on E-UTRA non-serving frequency carrier, and
- configured with an appropriate measurement gap pattern according to Table 9.1.2-3.

When the UE is in NE-DC operation mode and an NR–E-UTRAN FDD or TDD measurement (RSRP, RSRQ, RS-SINR, or E-CID) configured by NR PCell is on a E-UTRA serving frequency carrier, then the corresponding E-UTRA intra-frequency measurements requirements specified in clause 8.19 of TS 36.133 [15] shall apply.

Parameter T_{Inter1} used in inter-RAT requirements in clause 9.4 is specified in Table 9.4.1-1.

Table 9.4.1-1: Minimum available time for inter-RAT measurements

Gap Pattern Id	MeasurementGap Length (MGL, ms)	Measurement Gap Repetition Period (MGRP, ms)	Minimum available time for inter-frequency and inter-RAT measurements during 480 ms period (Tinter1, ms)
0	6	40	60
1	6	80	30
2	3	40	24 Note 1
3	3	80	12 Note 1
4	6	20	120 Note 1
6	4	20	72 Note 1,3,6
7	4	40	36 Note 1,4,6
8	4	80	18 Note 1,5,6
10	3	20	48 Note 1
NOTE 1: When determining UE requirements using Tinter1 for gap pattern IDs 2, 3, 4, 6, 7, 8, 10, Tinter1 = 60 for gap pattern IDs 2, 4, 6, 7, 10, and Tinter1 = 30 for gap pattern IDs 3 and 8 shall be used. NOTE 2: Measurement gaps pattern configurations applicability is as specified in Table 9.1.2-1. NOTE 3: When this gap pattern is used, the T_{inter} for E-UTRA inter-frequency measurements is 48 ms corresponding to the first 3 ms of the 4 ms gap. NOTE 4: When this gap pattern is used, the T_{inter} for E-UTRA inter-frequency measurements is 24 ms corresponding to the first 3 ms of the 4 ms gap. NOTE 5: When this gap pattern is used, the T_{inter} for E-UTRA inter-frequency measurements is 12 ms corresponding to the first 3 ms of the 4 ms gap. NOTE 6: This gap pattern is applicable for E-UTRA inter-frequency measurements only if gap based NR measurements are also configured.			

A UE configured with gap pattern ID 2, 3 or 10 shall be able to detect a target cell, provided that

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell begins not earlier than 500 μs from the start of the measurement gap, and
- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell ends not later than 500 μs before the end of the measurement gap in case of FDD and not later than 750 μs before the end of measurement gap in case of TDD.

A UE configured with gap pattern ID 6, 7 or 8 shall be able to detect a target cell, provided that

- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell begins not earlier than 500 μs from the start of the measurement gap, and
- the E-UTRA subframe #0 or #5 of the target E-UTRAN cell ends no later than 1500 μs before the end of the measurement gap in case of FDD and no later than 1750 μs before the end of measurement gap in case of TDD.

9.4.2 NR − E-UTRAN FDD measurements

9.4.2.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN FDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

9.4.2.2 Requirements when no DRX is used

When the UE requires measurement gaps to identify and measure inter-RAT cells and an appropriate measurement gap pattern is scheduled, the UE shall be able to identify a new detectable FDD cell within $T_{\text{Identify, E-UTRAN FDD}}$ according to the following expression:

$$T_{\text{Identify,E-UTRAN FDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} \quad ms,$$

where:

$T_{\text{BasicIdentify}}$ = 480 ms,

T_{Inter1} is defined in clause 9.4.1,

$\text{CSSF}_{\text{interRAT}} = \text{CSSF}_{\text{within\_gap,i}}$ is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{\text{Measure, E-UTRAN FDD}}$ defined in Table 9.4.2.2-1.

Table 9.4.2.2-1: Measurement period and measurement bandwidth

Configuration	Physical Layer Measurement period: $T_{\text{Measure, E-UTRAN FDD}}$ [ms]	Measurement bandwidth [RB]
0	480 x $\text{CSSF}_{\text{interRAT}}$	6
1 (Note 1)	240 x $\text{CSSF}_{\text{interRAT}}$	50
NOTE 1: This configuration is optional.		

The UE shall be capable of identifying and performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD carrier frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.2.3 Requirements when DRX is used

When DRX is in use and measurement gaps are configured, the UE shall be able to identify a new detectable E-UTRAN FDD cell within $T_{\text{Identify, E-UTRAN FDD}}$ specified in Table 9.4.2.3-1. When RRM enhancement for high speed is configured the UE shall be able to identify a new detectable E-UTRAN FDD cell within $T_{\text{Identify, E-UTRAN FDD}}$ specified in Table 9.4.2.3-2.

Table 9.4.2.3-1: Requirement to identify a newly detectable E-UTRAN FDD cell

DRX cycle length (s)	$T_{\text{Identify, E-UTRAN FDD}}$ (s) (DRX cycles)	
	Gap period = 40 ms, 20 ms	Gap period = 80 ms
≤0.16	Non-DRX requirements in clause 9.4.2.2 apply	Non-DRX requirements in clause 9.4.2.2 apply
0.256	5.12* $\text{CSSF}_{\text{interRAT}}$ (20*$\text{CSSF}_{\text{interRAT}}$)	7.68* $\text{CSSF}_{\text{interRAT}}$ (30*$\text{CSSF}_{\text{interRAT}}$)
0.32	6.4* $\text{CSSF}_{\text{interRAT}}$ (20*$\text{CSSF}_{\text{interRAT}}$)	7.68* $\text{CSSF}_{\text{interRAT}}$ (24*$\text{CSSF}_{\text{interRAT}}$)
0.32< DRX-cycle ≤ 10.24	Note1 (20*$\text{CSSF}_{\text{interRAT}}$)	Note1 (20*$\text{CSSF}_{\text{interRAT}}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $\text{CSSF}_{\text{interRAT}}$ is as defined in clause 9.4.2.2.		

Table 9.4.2.3-2: Requirement to identify a newly detectable E-UTRAN FDD cell for UE configured with RRM enhancement for high speed

DRX cycle length (s)	$T_{Identify, E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)	
	Gap period = 40 ms, 20 ms	Gap period = 80 ms
≤0.16	Non-DRX requirements in clause 9.4.2.2 apply	Non-DRX requirements in clause 9.4.2.2 apply
0.16<DRx cycle<=0.32	Note 1(15*$CSSF_{interRAT}$)	
0.32<DRx cycle <= 0.64	Note 1(10*$CSSF_{interRAT}$)	
DRx cycle = 1.024	Note 1(10*$CSSF_{interRAT}$)	Note 1(10*$CSSF_{interRAT}$)
DRx cycle = 1.28	Note 1(8*$CSSF_{interRAT}$)	Note 1(8*$CSSF_{interRAT}$)
1.28< DRX-cycle ≤10.24	Note1 (20*$CSSF_{interRAT}$)	Note1 (20*$CSSF_{interRAT}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2.		

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN FDD cells per E-UTRA FDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA FDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure, E\text{-}UTRAN\ FDD}$ specified in Table 9.4.2.3-2.

Table 9.4.2.3-2: Requirement to measure E-UTRAN FDD cells

DRX cycle length (s)	$T_{measure, E\text{-}UTRAN\ FDD}$ (s) (DRX cycles)
≤0.08	Non-DRX requirements in clause 9.4.2.2 apply
0.08< DRX-cycle ≤10.24	Note1 (5* $CSSF_{interRAT}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2.	

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN FDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2.
The NR – E-UTRAN FDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3.
The NR – E-UTRAN FDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.2.4 Measurement reporting requirements

9.4.2.4.1 Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

9.4.2.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.2.4.3.

9.4.2.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN FDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The UE shall not send any event-triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{\text{Identify, E-UTRAN FDD}}$ defined in clauses 9.4.2.2 and 9.4.2.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{\text{Identify, E-UTRAN FDD}}$ becomes undetectable for a period ≤ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{\text{Measure, E-UTRAN FDD}}$ provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used.

9.4.3 NR − E-UTRAN TDD measurements

9.4.3.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements.

In the requirements, an E-UTRAN TDD cell is considered to be detectable when:

- RSRP related conditions in the accuracy requirements in clause 10.2.2 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],
- RSRQ related conditions in the accuracy requirements in clause 10.2.3 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.3 of TS 36.133 [15],

  RS-SINR related conditions in the accuracy requirements in clause 10.2.5 are fulfilled for a corresponding Band, together with the corresponding side conditions in Annex B.2.3 and Annex B.3.19 of TS 36.133 [15].

9.4.3.2 Requirements when no DRX is used

When the UE requires measurement gaps to identify and measure inter-RAT cells and an appropriate measurement gap pattern is scheduled, the UE shall be able to identify a new detectable TDD cell within $T_{\text{Identify, E-UTRAN TDD}}$ according to the following expression:

- When configuration 0 or configuration 1 in Table 9.4.3.2-1 is applied,

$$T_{\text{Identify,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} \quad ms,$$

- When configuration 2 or configuration 3 in Table 9.4.3.2-1 is applied,

$$T_{\text{Identify,E-UTRAN TDD}} = T_{\text{BasicIdentify}} \cdot \frac{480}{T_{\text{Inter1}}} \cdot \text{CSSF}_{\text{interRAT}} + 240 \cdot \text{CSSF}_{\text{interRAT}} \quad ms,$$

where:

$T_{\text{BasicIdentify}}$ = 480 ms,

T_{Inter1} is defined in clause 9.4.1,

$\text{CSSF}_{\text{interRAT}} = \text{CSSF}_{\text{within\_gap,i}}$ is the scaling factor for the measured inter-RAT E-UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

Identification of a cell shall include detection of the cell and additionally performing a single measurement with measurement period of $T_{\text{Measure, E-UTRAN TDD}}$ defined in Table 9.4.3.2-1.

Table 9.4.3.2-1: $T_{Measure, E-UTRAN TDD}$ for different configurations

Configuration	Measurement bandwidth (RB)	Number of UL/DL sub-frames per half frame (5 ms)		DwPTS		$T_{Measure, E-UTRAN TDD}$ (ms)
		DL	UL	Normal CP	Extended CP	
0	6	2	2	$19760 \cdot T_s$	$20480 \cdot T_s$	480 x $CSSF_{interRAT}$
1 (Note 1)	50	2	2	$19760 \cdot T_s$	$20480 \cdot T_s$	240 x $CSSF_{interRAT}$
2	6	1	3	$19760 \cdot T_s$	$20480 \cdot T_s$	720 x $CSSF_{interRAT}$
3 (Note 1)	50	1	3	$19760 \cdot T_s$	$20480 \cdot T_s$	480 x $CSSF_{interRAT}$
NOTE 1: This configuration is optional. NOTE 2: Void						

The UE shall be capable of identifying and performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD carrier frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers.

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.3.3 Requirements when DRX is used

When DRX is in use and measurement gaps are configured, the UE shall be able to identify a new detectable E-UTRAN TDD cell within $T_{Identify, E-UTRAN TDD}$ specified in Table 9.4.3.3-1. When RRM enhancement for high speed is configured the UE shall be able to identify a new detectable E-UTRAN TDD cell within $T_{Identify, E-UTRAN TDD}$ specified in Table 9.4.3.3-2.

Table 9.4.3.3-1: Requirement to identify a newly detectable E-UTRAN TDD cell

DRX cycle length (s)	$T_{Identify, E-UTRAN TDD}$ (s) (DRX cycles)	
	Gap period = 40 ms, 20 ms	Gap period = 80 ms
≤0.16	Non-DRX requirements in clause 9.4.3.2 apply	Non-DRX requirements in clause 9.4.3.2 apply
0.256	5.12* $CSSF_{interRAT}$ (20*$CSSF_{interRAT}$)	7.68* $CSSF_{interRAT}$ (30*$CSSF_{interRAT}$)
0.32	6.4* $CSSF_{interRAT}$ (20*$CSSF_{interRAT}$)	7.68* $CSSF_{interRAT}$ (24*$CSSF_{interRAT}$)
0.32< DRX-cycle ≤10.24	Note1 (20*$CSSF_{interRAT}$)	Note1 (20*$CSSF_{interRAT}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.3.2.		

Table 9.4.3.3-2: Requirement to identify a newly detectable E-UTRAN TDD cell for UE configured with RRM enhancement for high speed

DRX cycle length (s)	$T_{Identify, E-UTRAN TDD}$ (s) (DRX cycles)	
	Gap period = 40 ms, 20 ms	Gap period = 80 ms
≤0.16	Non-DRX requirements in clause 9.4.3.2 apply	Non-DRX requirements in clause 9.4.3.2 apply
0.16<DRx cycle<=0.32	Note 1(15*$CSSF_{interRAT}$)	
0.32<DRx cycle <= 0.64	Note 1(10*$CSSF_{interRAT}$)	
DRx cycle = 1.024	Note 1(10*$CSSF_{interRAT}$)	Note 1(10*$CSSF_{interRAT}$)
DRx cycle = 1.28	Note 1(8*$CSSF_{interRAT}$)	Note 1(8*$CSSF_{interRAT}$)
1.28< DRX-cycle ≤10.24	Note1 (20*$CSSF_{interRAT}$)	Note1 (20*$CSSF_{interRAT}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.3.2.		

When DRX is in use, the UE shall be capable of performing NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements of at least 4 identified E-UTRAN TDD cells per E-UTRA TDD frequency layer during each layer 1 measurement period, for up to 7 E-UTRA TDD carrier frequency layers, and the UE physical layer shall be capable of reporting NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements to higher layers with the measurement period $T_{measure, E-UTRAN TDD}$ specified in Table 9.4.3.3-2.

Table 9.4.3.3-2: Requirement to measure E-UTRAN TDD cells

DRX cycle length (s)	$T_{measure, E-UTRAN TDD}$ (s) (DRX cycles)
≤0.08	Non-DRX Requirements in clause 9.4.3.2 apply
0.128	For configuration 2 Note3, non-DRX requirements in clause 9.4.3.2 apply, Otherwise: Note1 (5*$CSSF_{interRAT}$)
0.128<DRX-cycle≤ 10.24	Note1 (5*$CSSF_{interRAT}$)
NOTE 1: The time depends on the DRX cycle length. NOTE 2: $CSSF_{interRAT}$ is as defined in clause 9.4.3.2. NOTE 3: See Table 9.4.3.2-1.	

If higher layer filtering is used, an additional cell identification delay can be expected.

The NR – E-UTRAN TDD RSRP measurement accuracy for all measured cells shall be as specified in clause 10.2.2. The NR – E-UTRAN TDD RSRQ measurement accuracy for all measured cells shall be as specified in clause 10.2.3. The NR – E-UTRAN TDD RS-SINR measurement accuracy for all measured cells shall be as specified in clause 10.2.5.

9.4.3.4 Measurement reporting requirements

9.4.3.4.1 Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

9.4.3.4.2 Event-Triggered Periodic Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The first report in event-triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.3.4.3.

9.4.3.4.3 Event-Triggered Reporting

The reported NR – E-UTRAN TDD RSRP, RSRQ, and RS-SINR measurements contained in event-triggered measurement reports shall meet the requirements in clauses 10.2.2, 10.2.3, and 10.2.5, respectively.

The UE shall not send any event-triggered measurement reports as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{\text{Identify, E-UTRAN TDD}}$ defined in clauses 9.4.3.2 and 9.4.3.3 without DRX and with DRX, respectively. When L3 filtering is used, an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{\text{Identify, E-UTRAN TDD}}$ becomes undetectable for a period $\leqslant$ 5 seconds and then the cell becomes detectable again and triggers an event as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{\text{Measure, E-UTRAN TDD}}$ provided the timing to that cell has not changed more than ± 50 Ts while measurement gap has not been available and the L3 filter has not been used.

9.4.4 Inter-RAT RSTD measurements

9.4.4.1 NR − E-UTRAN FDD RSTD measurements

9.4.4.1.1 Introduction

The requirements are applicable for NR−E-UTRAN FDD RSTD measurements requested via LPP [22, 27].

When the UE is in NE-DC operation mode and an NR–E-UTRAN FDD RSTD measurement configured by NR PCell is on a E-UTRA serving frequency carrier, then the corresponding E-UTRA intra-frequency measurements requirements as follows shall apply.

- Measurements configured on E-UTRA PSCC shall meet E-UTRAN OTDOA intra-frequency measurements requirements in clause 8.1.2.5. The applicable measurement accuracy requirements are in clause 9.1.10.
- Measurements configured on E-UTRA SCC shall meet all applicable requirements in clause 8.4, except that the terms PCell and primary component carrier shall be deemed to be swapped with PSCell and PSCC. The applicable measurement accuracy requirements are in clause 9.1.12, except that the terms PCell and primary component carrier shall be deemed to be swapped with PSCell and PSCC.

The requirements in clause 9.4.4.1 apply when:

- the UE is provided with the LTE timing information via LPP [27], including both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset*, or
- the UE is not provided with *nr-LTE-SFN-Offset* or *nr-LTE-fineTiming-Offset*, or
- the UE is provided with *nr-LTE-SFN-Offset* but not with *nr-LTE-fineTiming-Offset*.

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE may be using autonomous gaps to acquire SFN of the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $T_{\text{RSTD InterRAT, E-UTRAN FDD}}$ time period starts while meeting all the requirements in clause 9.4.4.1.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to acquire the SFN before the $T_{\text{RSTD InterRAT, E-UTRAN FDD}}$ starts.

When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may need to request measurement gaps to perform cell detection for the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA

RSTD measurements before the $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ time period starts while meeting all the requirements in clause 9.4.4.1.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to detect the cell before the $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ starts.

9.4.4.1.2 Requirements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-RAT E-UTRAN FDD RSTD, specified in TS 38.215 [4], for at least *n*=16 cells, including the reference cell, within $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ ms as given below:

$$\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}} = T_{\text{PRS}} \cdot (M - 1) + \Delta \qquad ms,$$

where

$\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ is the total time for detecting and measuring at least *n* cells,

T_{PRS} is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [23], among the measured *n* cells including the reference cell,

M is the number of PRS positioning occasions as defined in Table 9.4.4.1.2-1, where each PRS positioning occasion comprises of N_{PRS} ($1 \leq N_{PRS} \leq 6$) consecutive downlink positioning subframes defined in TS 36.211 [23],

$CSSF_{interRAT}=CSSF_{within\_gap,i}$ is the scaling factor determined by the gap sharing scheme for the RSTD measurements on the carrier frequency *i* as defined in clause 9.1.5.2,

$\Delta = 160 \cdot \left\lceil \frac{n}{M} \right\rceil$ ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the *n* cells are distributed on up to two E-UTRAN FDD carrier frequencies.

Table 9.4.4.1.2-1: Number of PRS positioning occasions within $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$

Positioning subframe configuration period, T_{PRS}	Number of PRS positioning occasions, M	
	f2 Note1	f1 and f2 Note2
160 ms	16 × $CSSF_{interRAT}$	32 × $CSSF_{interRAT}$
>160 ms	8 × $CSSF_{interRAT}$	16 × $CSSF_{interRAT}$
NOTE 1: When inter-RAT E-UTRAN FDD RSTD measurements are performed over the reference cell and neighbour cells, which belong to the E-UTRAN FDD carrier frequency f2. NOTE 2: When inter-RAT E-UTRAN FDD RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the E-UTRAN FDD carrier frequency f1 and the E-UTRAN FDD carrier frequency f2 respectively.		

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells *i* out of at least (*n*-1) neighbor cells within $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN FDD}}$ provided:

$(\text{PRS } \hat{\text{E}}_\text{s} / \text{Iot})_{ref} \geq$-6 dB for all Frequency Bands for the reference cell,

$(\text{PRS } \hat{\text{E}}_\text{s} / \text{Iot})_{i} \geq$-13 dB for all Frequency Bands for neighbour cell *i*,

$(\text{PRS } \hat{\text{E}}_\text{s} / \text{Iot})_{ref}$ and $(\text{PRS } \hat{\text{E}}_\text{s} / \text{Iot})_{i}$ conditions apply for all subframes of at least $L = \frac{M}{2}$ PRS positioning occasions,

PRP $1,2|_{dBm}$ according to TS 36.133 [15, Annex B.2.6] for a corresponding Band,

$\mathrm{PRS}\,\hat{\mathrm{E}}_s / \mathrm{Iot}$ is defined as the ratio of the average received energy per PRS resource element during the useful part of the symbol to the average received power spectral density of the total noise and interference for this resource element, where the ratio is measured over all resource elements which carry PRS.

The time $T_{\text{RSTD InterRAT, E-UTRAN FDD}}$ starts from the first subframe of the PRS positioning occasion closest in time after both the *OTDOA-RequestLocationInformation* message and the OTDOA assistance data in the *OTDOA-ProvideAssistanceData* message via LPP as specified in TS 38.305 [22], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in clause 10.2.4.

9.4.4.1.2.1 RSTD Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

9.4.4.1.2.2 Requirements for acquiring the timing of the E-UTRA OTDOA reference cell

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE supporting per-FR gaps may make autonomous gaps in downlink reception and uplink transmission of the PCell, PSCell, and each of the SCells in FR1 for acquiring SFN of the reference cell in the E-UTRA OTDOA assistance data, while no autonomous gaps in downlink reception or uplink transmission are allowed in any of the UE serving cells in FR2. The UE, which are only supporting per-UE gaps, may make autonomous gaps in downlink reception and uplink transmission of the PCell, PSCell, and each of the SCells for acquiring the SFN of the reference cell in the E-UTRA OTDOA assistance data.

When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may need to request measurement gaps while indicating *eutra-FineTimingDetection* according to TS 38.331 [2] for detecting the reference cell in the E-UTRA OTDOA assistance data.

When the UE is performing one or both of SFN acquisition or cell detection as specified above, the UE shall be able to determine the timing of the E-UTRA OTDOA assistance data reference cell during the time period

$$T_{\text{RefCell,E-UTRAN}} = T_{\text{Detect, E-UTRAN FDD}} + T_{\text{MIB}} + T_{\text{ECGI}}\ ,$$

where

$T_{\text{Detect, E-UTRAN FDD}} = T_{\text{Identify, E-UTRAN FDD}} - T_{\text{measure, E-UTRAN FDD}}$ is according to clause 9.4.2 assuming $CSSF_{\text{interRAT}}$=1 and it is the time needed to detect the E-UTRA OTDOA assistance data reference cell when the UE needs to acquire the subframe and slot timing of the cell, provided the UE is configured with measurement gaps ($T_{\text{Detect, E-UTRAN FDD}}$=0 when both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset* are provided in the E-UTRA OTDOA assistance data or the E-UTRA OTDOA assistance data reference cell is known to the UE), and

T_{MIB} = 50 ms is the time required to acquire SFN and/or PHICH configuration of the E-UTRA OTDOA assistance data reference cell provided the OTDOA assistance data reference cell is decodable and at least all E-UTRA subframes #0 during T_{MIB} are available at the UE receiver (T_{MIB}=0 when *nr-LTE-SFN-Offset* is provided in the E-UTRA OTDOA assistance data and ECGI acquisition is not needed), and

T_{ECGI} = 100 ms is the time required to acquire ECGI of the E-UTRA OTDOA assistance data reference cell when *cellGlobalId* is included in *OTDOA-ReferenceCellInfo* and the UE is not aware of the ECGI of this cell (T_{ECGI} = 0 when *cellGlobalId* is not included in *OTDOA-ReferenceCellInfo* or the UE is aware of the ECGI of the E-UTRA OTDOA assistance data reference cell).

When detecting the E-UTRAN OTDOA reference cell, the requirements in this clause shall be met, provided the conditions for the detectable cell are fulfilled according to clause 9.4.2.1. In addition, the MIB of the E-UTRA OTDOA reference cell whose SFN is acquired shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to TS 36.101 [25].

The requirement for acquiring the timing of the E-UTRA OTDOA reference cell within $T_{RefCell,E\text{-}UTRAN}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

When T_{MIB}>0 and UE is using autonomous gaps during T_{MIB}, the UE shall transmit at least $N_{ACK/NACK, MIB, FDD}$ ACK/NACKs on PCell, PSCell, and each of activated SCell(s) in the frequency range where the autonomous gaps are created, specified in Table 9.4.4.1.2.2-1. When both T_{MIB}>0 and T_{ECGI}>0 and UE is using autonomous gaps during T_{MIB}+T_{ECGI}, the UE shall transmit on PCell, PSCell, and each of activated SCell(s) in the frequency range where autonomous gaps are created at least $N_{ACK/NACK, MIB+ECGI, FDD}$ ACK/NACKs specified in Table 9.4.4.1.2.2-3, provided the OTDOA reference cell bandwidth is configured in the OTDOA assistance data [22, 27]. The requirements in Tables 9.4.4.1.2.2-1, 9.4.4.1.2.2-2, and 9.4.4.1.2.2-3 apply, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured,
- SSBs are transmitted in one slot within SMTC window.

Table 9.4.4.1.2.2-2: Void

Table 9.4.4.1.2.2-2: Number of ACK/NACKs transmitted by the UE during T_{ECGI}

$N_{ACK/NACK, ECGI, FDD}$	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
66	FDD	15 kHz
145	FDD	30 kHz
298	FDD	60 kHz
28	TDD Note 1	15 kHz
67	TDD Note 1	30 kHz
144	TDD Note 1	60 kHz
175	TDD Note 2	60 kHz
363	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

Table 9.4.4.1.2.2-3: Number of ACK/NACKs transmitted by the UE during T_{MIB}+T_{ECGI}

$N_{ACK/NACK, MIB+ECGI, FDD}$	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

9.4.4.2 NR − E-UTRAN TDD RSTD measurements

9.4.4.2.1 Introduction

The requirements are applicable for NR−E-UTRAN TDD RSTD measurements requested via LPP [22, 27].

When the UE is in NE-DC operation mode and an NR–E-UTRAN TDD RSTD measurement configured by NR PCell is on a E-UTRA serving frequency carrier, then the corresponding E-UTRA intra-frequency measurements requirements as follows shall apply.

- Measurements configured on E-UTRA PSCC shall meet E-UTRAN OTDOA intra-frequency measurements requirements in clause 8.1.2.5. The applicable measurement accuracy requirements are in clause 9.1.10.
- Measurements configured on E-UTRA SCC shall meet all applicable requirements in clause 8.4, except that the terms PCell and primary component carrier shall be deemed to be swapped with PSCell and PSCC. The applicable measurement accuracy requirements are in clause 9.1.12, except that the terms PCell and primary component carrier shall be deemed to be swapped with PSCell and PSCC.

The requirements in clause 9.4.4.1 apply when:

- the UE is provided with the LTE timing information via LPP [27], including both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset*, or
- the UE is not provided with *nr-LTE-SFN-Offset* or *nr-LTE-fineTiming-Offset*, or
- the UE is provided with *nr-LTE-SFN-Offset* but not with *nr-LTE-fineTiming-Offset*.

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE may be using autonomous gaps to acquire SFN of the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN TDD}}$ time period starts while meeting all the requirements in clause 9.4.4.2.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to acquire the SFN before the $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN TDD}}$ starts. When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may need to request measurement gaps to perform cell detection for the OTDOA assistance data reference cell prior to requesting measurement gaps for performing the requested E-UTRA RSTD measurements before the $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN TDD}}$ time period starts while meeting all the requirements in clause 9.4.4.2.2, provided that the OTDOA assistance data is provided to allow sufficient time for the UE to detect the cell before the $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN TDD}}$ starts.

9.4.4.2.2 Requirements

When the physical layer cell identities of neighbour cells together with the OTDOA assistance data are provided, the UE shall be able to detect and measure inter-RAT -UTRAN TDD RSTD, specified in TS 38.215 [4], for at least *n*=16 cells, including the reference cell, within $\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN TDD}}$ ms as given below:

$$\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN TDD}} = T_{\text{PRS}} \cdot (M - 1) + \Delta \qquad ms \qquad ,$$

where

$\mathrm{T}_{\text{RSTD InterRAT, E-UTRAN TDD}}$ is the total time for detecting and measuring at least *n* cells,

T_{PRS} is the largest value of the cell-specific positioning subframe configuration period, defined in TS 36.211 [23], among the measured *n* cells including the reference cell,

M is the number of PRS positioning occasions as defined in Table 9.4.4.2.2-1, where a PRS positioning occasion is as defined in clause 9.4.4.1.2,

$\mathrm{CSSF}_{\text{interRAT}}$=$\mathrm{CSSF}_{\text{within\_gap,i}}$ is the scaling factor determined by the gap sharing scheme for the RSTD measurements on the carrier frequency *i* as defined in clause 9.1.5.2,

$\Delta = 160 \cdot \left\lceil \frac{n}{M} \right\rceil$ ms is the measurement time for a single PRS positioning occasion which includes the sampling time and the processing time, and

the n cells are distributed on up to two E-UTRAN TDD carrier frequencies.

Table 9.4.4.2.2-1: Number of PRS positioning occasions within $T_{\text{RSTD InterRAT, E-UTRAN TDD}}$

Positioning subframe configuration period, T_{PRS}	Number of PRS positioning occasions, M	
	f2 Note1	f1 and f2 Note2
160 ms	16 × $CSSF_{interRAT}$	32 × $CSSF_{interRAT}$
>160 ms	8 × $CSSF_{interRAT}$	16 × $CSSF_{interRAT}$
NOTE 1: When inter-RAT E-UTRAN TDD RSTD measurements are performed over the reference cell and neighbour cells, which belong to the E-UTRAN TDD carrier frequency f2. NOTE 2: When inter-RAT E-UTRAN TDD RSTD measurements are performed over the reference cell and the neighbour cells, which belong to the E-UTRAN TDD carrier frequency f1 and the E-UTRAN TDD carrier frequency f2 respectively.		

The requirements in this clause shall apply for all TDD special subframe configurations specified in TS 36.211 [23] and for the TDD uplink-downlink configurations as specified in Table 9.4.4.2.2-2 for UE requiring measurement gaps for these measurements. For UEs capable of performing inter-RAT RSTD measurements without measurement gaps, TDD uplink-downlink subframe configurations as specified in Table 9.4.4.2.2-3 shall apply.

Table 9.4.4.2.2-2: TDD uplink-downlink subframe configurations applicable for inter-RAT RSTD requirements

PRS Transmission Bandwidth (RB)	Applicable TDD uplink-downlink configurations
6, 15	3, 4 and 5
25	1, 2, 3, 4, 5 and 6
50, 75, 100	0, 1, 2, 3, 4, 5 and 6
NOTE 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [23].	

Table 9.4.4.2.2-3: TDD uplink-downlink subframe configurations applicable for inter-RAT RSTD requirements without gaps

PRS Transmission Bandwidth (RB)	Applicable TDD uplink-downlink configurations
6, 15	1, 2, 3, 4 and 5
25, 50, 75, 100	0, 1, 2, 3, 4, 5 and 6
NOTE 1: Uplink-downlink configurations are specified in Table 4.2-2 in TS 36.211 [23].	

The UE physical layer shall be capable of reporting RSTD for the reference cell and all the neighbor cells i out of at least (n-1) neighbor cells within $T_{\text{RSTD InterRAT, E-UTRAN TDD}}$ provided:

$\left(\text{PRS } \hat{E}_s / \text{Iot}\right)_{ref}$ ≥-6 dB for all Frequency Bands for the reference cell,

$\left(\text{PRS } \hat{E}_s / \text{Iot}\right)_i$ ≥-13 dB for all Frequency Bands for neighbour cell i,

$\left(\text{PRS } \hat{E}_s / \text{Iot}\right)_{ref}$ and $\left(\text{PRS } \hat{E}_s / \text{Iot}\right)_i$ conditions apply for all subframes of at least $L = \frac{M}{2}$ PRS positioning occasions,

PRP 1,2$|_{\text{dBm}}$ according to TS 36.133 [15, Annex B.2.6] for a corresponding Band,

$\text{PRS } \hat{E}_s / \text{Iot}$ is as defined in clause 9.4.4.1.2.

The time $T_{RSTD\ InterRAT,\ E\text{-}UTRAN\ TDD}$ starts from the first subframe of the PRS positioning occasion closest in time after both the OTDOA-RequestLocationInformation message and the OTDOA assistance data in the OTDOA-ProvideAssistanceData message via LPP as specified in TS 38.305 [22], are delivered to the physical layer of the UE.

The RSTD measurement accuracy for all measured neighbor cells *i* shall be fulfilled according to the accuracy as specified in clause 10.2.4.

9.4.4.2.2.1 RSTD Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

9.4.4.2.2.2 Requirements for acquiring the timing of the E-UTRA OTDOA reference cell

When the UE is not aware of the SFN of at least one LTE cell in the OTDOA assistance data, the UE supporting per-FR gaps may make autonomous gaps in downlink reception and uplink transmission of the PCell, PSCell, and each of the SCells in FR1 for acquiring SFN of the reference cell in the E-UTRA OTDOA assistance data, while no autonomous gaps in downlink reception or uplink transmission are allowed in any of the UE serving cells in FR2. The UE, which are only supporting per-UE gaps, may make autonomous gaps in downlink reception and uplink transmission of the PCell, PSCell, and each of the SCells for acquiring the SFN of the reference cell in the E-UTRA OTDOA assistance data.

When the UE is not aware of and cannot derive the subframe timing difference between the NR serving cell and the OTDOA assistance data reference cell, the UE may need to request measurement gaps while indicating *eutra-FineTimingDetection* according to TS 38.331 [2] for detecting the reference cell in the E-UTRA OTDOA assistance data.

When the UE is performing one or both of SFN acquisition or cell detection as specified above, the UE shall be able to determine the timing of the E-UTRA OTDOA assistance data reference cell during the time period

$$T_{RefCell,E\text{-}UTRAN} = T_{Detect,\ E\text{-}UTRAN\ TDD} + T_{MIB} + T_{ECGI}\ ,$$

where

$T_{Detect,\ E\text{-}UTRAN\ TDD} = T_{Identify,\ E\text{-}UTRAN\ TDD} - T_{measure,\ E\text{-}UTRAN\ TDD}$ is according to clause 9.4.3 assuming $CSSF_{interRAT}$=1 and it is the time needed to detect the E-UTRA OTDOA assistance data reference cell when the UE needs to acquire the subframe and slot timing of the cell, provided the UE is configured with measurement gaps ($T_{Detect,\ E\text{-}UTRAN\ TDD}$=0 when both *nr-LTE-SFN-Offset* and *nr-LTE-fineTiming-Offset* are provided in the E-UTRA OTDOA assistance data or the E-UTRA OTDOA assistance data reference cell is known to the UE), and

T_{MIB} = 50 ms is the time required to acquire SFN and/or PHICH configuration of the E-UTRA OTDOA assistance data reference cell provided the OTDOA assistance data reference cell is decodable and at least all E-UTRA subframes #0 during T_{MIB} are available at the UE receiver (T_{MIB}=0 when *nr-LTE-SFN-Offset* is provided in the E-UTRA OTDOA assistance data and ECGI acquisition is not needed), and

T_{ECGI} = 100 ms is the time required to acquire ECGI of the E-UTRA OTDOA assistance data reference cell when *cellGlobalId* is included in *OTDOA-ReferenceCellInfo* and the UE is not aware of the ECGI of this cell (T_{ECGI} = 0 when *cellGlobalId* is not included in *OTDOA-ReferenceCellInfo* or the UE is aware of the ECGI of the E-UTRA OTDOA assistance data reference cell).

When detecting the E-UTRAN OTDOA reference cell, the requirements in this clause shall be met, provided the conditions for the detectable cell are fulfilled according to clause 9.4.3.1. In addition, the MIB of the E-UTRA OTDOA reference cell whose SFN is acquired shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to TS 36.101 [25].

The requirement for acquiring the timing of the E-UTRA OTDOA reference cell within $T_{RefCell,E\text{-}UTRAN}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

When T_{MIB}>0 and UE is using autonomous gaps during T_{MIB}, the UE shall transmit at least $N_{ACK/NACK,\ MIB,\ TDD}$ ACK/NACKs on PCell, PSCell, and each of activated SCell(s) in the frequency range where the autonomous gaps are created, specified in Table 9.4.4.2.2.2-1. When both T_{MIB}>0 and T_{ECGI}>0 and UE is using autonomous gaps during

T_{MIB}+T_{ECGI}, the UE shall transmit on PCell, PSCell, and each of activated SCell(s) in the frequency range where autonomous gaps are created at least $N_{ACK/NACK, MIB+ECGI, TDD}$ ACK/NACKs specified in Table 9.4.4.2.2.2-3, provided the OTDOA reference cell bandwidth is configured in the OTDOA assistance data [22, 27]. The requirements in Tables 9.4.4.2.2.2-1, 9.4.4.2.2.2-2 and 9.4.4.2.2.2-3 apply, provided that:

- there is continuous DL data allocation,
- no DRX cycle is used,
- no measurement gaps are configured,
- only one code word is transmitted in each slot,
- 2 slot ACK/NACK feedback is configured,
- 20 ms SMTC period is configured,
- SSBs are transmitted in one slot within SMTC window.

Table 9.4.4.2.2.2-1: Minimum number of ACK/NACKs transmitted by the UE during T_{MIB}

$N_{ACK/NACK, MIB, TDD}$	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
15	FDD	15 kHz
39	FDD	30 kHz
85	FDD	60 kHz
0	TDD Note 1	15 kHz
4	TDD Note 1	30 kHz
12	TDD Note 1	60 kHz
46	TDD Note 2	60 kHz
104	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

Table 9.4.4.2.2.2-2: Void

Table 9.4.4.2.2.2-3: Minimum number of ACK/NACKs transmitted by the UE during T_{MIB}+T_{ECGI}

$N_{ACK/NACK, MIB+ECGI, TDD}$	Configuration of the serving cell in which the transmitted ACK/NACKs are counted	
	Duplex mode configuration	SCS
84	FDD	15 kHz
193	FDD	30 kHz
402	FDD	60 kHz
28	TDD Note 1	15 kHz
81	TDD Note 1	30 kHz
159	TDD Note 1	60 kHz
233	TDD Note 2	60 kHz
491	TDD Note 2	120 kHz
NOTE 1: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-1 [18]. NOTE 2: TDD UL-DL configuration is as specified in Table A.3.3.1-1 of TS 38.101-2 [19].		

9.4.5 Inter-RAT E-CID measurements

9.4.5.1 NR−E-UTRAN FDD E-CID RSRP and RSRQ measurements

9.4.5.1.1 Introduction

The requirements in clause 9.4.5.1. shall apply provided the UE has received *ECID-RequestLocationInformation* message from LMF via LPP requesting the UE to report inter-RAT E-UTRAN FDD E-CID RSRP and RSRQ measurements [22, 27].

9.4.5.1.2 Requirements

The requirements in clause 9.4.2 also apply for this clause except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in clause 9.4.5.1.3.

9.4.5.1.3 Measurement Reporting Delay

This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2 and 10.2.3, respectively.

9.4.5.2 NR−E-UTRAN TDD E-CID RSRP and RSRQ measurements

9.4.5.2.1 Introduction

The requirements in clause 9.4.5.2. shall apply provided the UE has received *ECID-RequestLocationInformation* message from LMF via LPP requesting the UE to report inter-RAT E-UTRAN TDD E-CID RSRP and RSRQ measurements [22, 27].

9.4.5.2.2 Requirements

The requirements in clause 9.4.3 also apply for this clause except the measurement reporting requirements. The measurement reporting requirements for E-CID RSRP and RSRQ are defined in clause 9.4.5.2.3.

9.4.5.2.3 Measurement Reporting Delay

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

Reported RSRP and RSRQ measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.2.2 and 10.2.3, respectively.

9.4.6 NR − UTRAN FDD measurements

9.4.6.1 Introduction

The requirements are applicable for NR− UTRAN FDD CPICH RSCP and CPICH Ec/No measurements for SRVCC.

9.4.6.2 Requirements when no DRX is used

9.4.6.2.1 Identification of a new UTRA FDD cell

When explicit neighbour list is provided and no DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the monitored set within

$$T_{\text{identify, UTRA\_FDD}} = T_{\text{basic\_identify\_UTRA\_FDD}} \cdot \frac{480}{T_{\text{inter1}}} \cdot CSSF_{\text{interRAT}} \quad ms$$

A cell shall be considered detectable when

- CPICH Ec/Io $\geq$ -20 dB,
- SCH_Ec/Io $\geq$ -17 dB for at least one channel tap and SCH_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

9.4.6.2.2 UE UTRA FDD CPICH measurement capability

When measurement gaps are scheduled for UTRA FDD inter RAT measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting measurements to higher layers with measurement accuracy as specified in Clause 10 with measurement period given by

$$T_{\text{measurement\_UTRA\_FDD}} = Max\left\{T_{\text{Measurement\_Period UTRA\_FDD}} \cdot CSSF_{\text{interRAT}}, T_{\text{basic\_measurement\_UTRA\_FDD}} \cdot \frac{480}{T_{\text{inter1}}} \cdot CSSF_{\text{interRAT}}\right\} ms$$

The UE shall be capable of performing UTRA FDD CPICH measurements for $X_{\text{basic measurementUTRA\_FDD}}$ inter-frequency cells per FDD frequency and the UE physical layer shall be capable of reporting measurements to higher layers with the measurement period of $T_{\text{Measurement\_ UTRA\_FDD}}$.

$X_{\text{basic measurement UTRA\_FDD}} = 6$

$T_{\text{Measurement\_Period UTRA\_FDD}}$ = 480 ms. The period used for calculating the measurement period $T_{\text{measurement\_UTRA\_FDD}}$ for UTRA FDD CPICH measurements.

$T_{\text{basic\_identify\_UTRA\_FDD}}$ = 300 ms. This is the time period used in the inter RAT equation in clause 9.4.6.2.1 where the maximum allowed time for the UE to identify a new UTRA FDD cell is defined.

$T_{\text{basic\_measurement\_UTRA\_FDD}}$ = 50 ms. This is the time period used in the equation for defining the measurement period for inter RAT CPICH measurements.

$CSSF_{\text{interRAT}} = CSSF_{\text{within\_gap,i}}$ is the scaling factor for the measured inter-RAT UTRA carrier *i* which is calculated as specified in clause 9.1.5.2.

T_{inter1} is defined in clause 9.4.1.

9.4.6.2.3 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 10.

9.4.6.2.4 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 10.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify,\ UTRA\_FDD}$ defined in Clause 9.4.6.2.1 for the minimum requirements. When L3 filtering is used an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{identify,\ UTRA\_FDD}$ defined in clause 9.4.6.2.1 for the minimum requirements and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{measurement\_UTRA\_FDD}$ defined in clause 9.4.6.2.2 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

9.4.6.2.5 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 10.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.6.2.4 Event Triggered Reporting.

9.4.6.3 Requirements when DRX is used

When explicit neighbour list is provided and DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable cell belonging to the neighbour cell list within $T_{identify,UTRA\_FDD}$ as shown in table 9.4.6.3-1

Table 9.4.6.3-1: Requirement to identify a newly detectable UTRA FDD cell

DRX cycle length (s)	**$T_{identify\_UTRA\_FDD}$ (s) (DRX cycles)**	
	Gap period = 40 ms	Gap period = 80 ms
≤0.04	Non DRX Requirements in clause 9.4.6.2 are applicable	Non DRX Requirements in clause 9.4.6.2 are applicable
0.064	2.56 *$CSSF_{interRAT}$ (40*$CSSF_{interRAT}$)	4.8 *$CSSF_{interRAT}$ (75 *$CSSF_{interRAT}$)
0.08	3.2 *$CSSF_{interRAT}$ (40 *$CSSF_{interRAT}$)	4.8 *$CSSF_{interRAT}$ (60* $CSSF_{interRAT}$)
0.128	3.2 *$CSSF_{interRAT}$ (25* $CSSF_{interRAT}$)	4.8 *$CSSF_{interRAT}$ (37.5* $CSSF_{interRAT}$)
0.16	3.2 *$CSSF_{interRAT}$ (20 *$CSSF_{interRAT}$)	4.8 *$CSSF_{interRAT}$ (30 *$CSSF_{interRAT}$)
0.16<DRX-cycle≤2.56	Note1 (20 *$CSSF_{interRAT}$)	Note1 (20 *$CSSF_{interRAT}$)
Note 1: Time depends upon the DRX cycle in use. Note 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2.		

A cell shall be considered detectable provided following conditions are fulfilled: A cell shall be considered detectable when

- CPICH Ec/Io $\geq$ -20 dB,
- SCH_Ec/Io $\geq$ -17 dB for at least one channel tap and SCH_Ec/Ior is equally divided between primary synchronisation code and secondary synchronisation code. When L3 filtering is used an additional delay can be expected.

The UE shall be capable of performing RSCP and Ec/Io measurements of at least 6 UTRA cells per UTRA FDD carrier for up to 3 UTRA FDD carriers and the UE physical layer shall be capable of reporting RSCP and Ec/Io measurements to higher layers with the measurement period defined in table 9.4.6.3-2 when DRX is used, either measurement gaps are scheduled or the UE supports capability of conducting such measurements without gaps.

Table 9.4.6.3-2: Requirement to measure UTRA FDD cells

DRX cycle length (s)	$T_{measure\_UTRA\_FDD}$ (s) (DRX cycles)	
	Gap period = 40 ms	**Gap period = 80 ms**
≤0.04	Non DRX Requirements in clause 9.4.6.2 are applicable	Non DRX Requirements in clause 9.4.6.2 are applicable
0.064	0.48* $CSSF_{interRAT}$ (7.5* N_{freq}*$CSSF_{interRAT}$)	0.8 *$CSSF_{interRAT}$ (12.5 *$CSSF_{interRAT}$)
0.08	0.48 *$CSSF_{interRAT}$ (6 *$CSSF_{interRAT}$)	0. 8*$CSSF_{interRAT}$ (10 *$CSSF_{interRAT}$)
0.128	0.64 *$CSSF_{interRAT}$ (5 *$CSSF_{interRAT}$)	0. 8 *$CSSF_{interRAT}$ (6.25 *$CSSF_{interRAT}$)
0.128<DRX-cycle≤2.56	Note1 (5 *$CSSF_{interRAT}$)	Note1 (5 *$CSSF_{interRAT}$)
Note 1: Time depends upon the DRX cycle in use. Note 2: $CSSF_{interRAT}$ is as defined in clause 9.4.2.2.		

The measurement accuracy for all measured cells shall be as specified in the clause 10.3.

9.4.6.3.1 Periodic Reporting

Reported measurements in periodically triggered measurement reports shall meet the requirements in clause 10.

9.4.6.3.2 Event Triggered Reporting

Reported measurements in event triggered measurement reports shall meet the requirements in clause 10.

The UE shall not send any event triggered measurement reports, as long as the reporting criteria is not fulfilled.

The measurement reporting delay is defined as the time between any event that will trigger a measurement report until the UE starts to transmit the measurement report over the Uu interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is twice the TTI of the uplink DCCH. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than $T_{identify,UTRA\_FDD}$ defined in Clause 9.4.6.3. When L3 filtering is used an additional delay can be expected.

If a cell which has been detectable at least for the time period $T_{identify,\ UTRA\_FDD}$ defined in clause 9.4.6.3 and then triggers the measurement report as per TS 38.331 [2], the event triggered measurement reporting delay shall be less than $T_{measurement\_UTRA\_FDD}$ defined in clause 9.4.6.3 provided the timing to that cell has not changed more than ± 32 chips while measurement gap has not been available and the L3 filter has not been used. When L3 filtering is used, an additional delay can be expected.

9.4.6.3.3 Event-triggered Periodic Reporting

Reported measurements contained in event triggered periodic measurement reports shall meet the requirements in clause 10.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.4.6.3.2 Event Triggered Reporting.

9.4.7 NR – E-UTRAN measurements with autonomous gaps

9.4.7.1 Reporting delay due to E-UTRAN CGI reading with autonomous gaps

The requirements in this clause apply when the UE is configured with standalone NR or NE-DC. The UE shall identify and report the CGI when requested by an NR PCell for the purpose 'reportCGI'. The UE may make autonomous gaps in downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3.1 in TS 36.331 [16].. If autonomous gaps are used for measurement with the purpose of 'reportCGI', regardless of whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of E-UTRA cell within $T_{\mathrm{identify\_CGI,\,E\text{-}UTAN}}$= 150 ms. This is the maximum allowed time for the UE to identify a new CGI of an E-UTRA cell, provided that the E-UTRA cell has been already identified by the UE.

A cell shall be considered identifiable following conditions are fulfilled:

- RSRP related side conditions given in Clause 9.1 in [15] are fulfilled for a corresponding Band,
- SCH_RP and SCH Ês/Iot according to Annex B.2.2 in [15] for a corresponding Band

The MIB of an E-UTRA cell whose CGI is identified shall be considered decodable by the UE provided the PBCH demodulation requirements are met according to [25].

The requirement for identifying a new CGI of an E-UTRA cell within $T_{\mathrm{identify\_CGI,\,E\text{-}UTRAN}}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

9.5 L1-RSRP measurements for Reporting

9.5.1 Introduction

When configured by the network, the UE shall be able to perform L1-RSRP measurements of configured CSI-RS, SSB or CSI-RS and SSB resources for L1-RSRP. The measurements shall be performed for a serving cell, including PCell, PSCell, or SCell, on the resources configured for L1-RSRP measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet* within the CSI-Resource*Config* settings configured for L1-RSRP for the active BWP, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

9.5.2 Requirements applicability

The requirements in clause 9.5 apply, provided:

- The CSI-RS or SSB or CSI-RS and SSB resources configured for L1-RSRP measurements are measurable.

An SSB resource configured for L1-RSRP shall be considered measurable when for each relevant SSB the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.1.19.1 and 10.1.20.1 for FR1 and FR2, respectively, for a corresponding band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.4.1 for a corresponding band.

A CSI-RS resource configured for L1-RSRP shall be considered measurable when for each relevant CSI-RS the following conditions are met:

- L1-RSRP related side conditions given in clauses 10.1.19.2 and 10.1.20.2 for FR1 and FR2, respectively, for a corresponding band,
- CSI-RS_RP and CSI-RS Ês/Iot according to Annex B.2.4.2 for a corresponding band.

A CSI-RS and SSB resource configured for L1-RSRP shall be considered measurable when the measurable resource conditions are met for both CSI-RS resource and SSB resource.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

9.5.3 Measurement Reporting Requirements

The UE shall send L1-RSRP reports only for report configurations configured for the active BWP.

The UE shall report the L1-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1dB step size according to clause 10.1.19 for FR1 and 10.1.20 for FR2 if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-RSRP based reporting as defined in clause 10.1.19 for FR1 and 10.1.20 for FR2. The differential L1-RSRP is quantized to a 4-bit value with 2dB step size. The mapping between the reported L1-RSRP value and the measured quantity is described in 10.1.6.

In EN-DC and NE-DC operation, when the UE is configured to perform E-UTRA SRS carrier-based switching an additional delay can be expected in FR1 if the UE is capable of per-FR gap, or an additional delay can be expected in both FR1 and FR2 if the UE is not capable of per-FR gap.

9.5.3.1 Periodic Reporting

Reported L1-RSRP measurements contained in periodic L1-RSRP measurement reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send periodic L1-RSRP measurement reports for an active BWP.

The UE shall transmit the periodic L1-RSRP reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5.3.2 Semi-Persistent Reporting

Reported L1-RSRP measurements contained in a Semi-Persistent L1-RSRP measurement report shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively. This requirement applies for semi-persistent L1-RSRP reports send on PUSCH or PUCCH.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUSCH, if a DCI request has been received.

The UE shall only send semi-persistent L1-RSRP measurement reports on PUCCH, if an activation command [7] has been received.

The UE shall transmit the semi-persistent L1-RSRP reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.5.3.3 Aperiodic Reporting

Reported L1-RSRP measurements contained in aperiodic triggered, aperiodic triggered periodic and aperiodic triggered semi-persistent L1-RSRP reports shall meet the requirements in clauses 10.1.19 for FR1 and 10.1.20 for FR2, respectively.

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI trigger has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 6.1.2.1 in TS 38.214 [26].

9.5.4 L1-RSRP measurement requirements

9.5.4.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP\_Measurement\_Period\_SSB}$.

The value of $T_{L1\text{-}RSRP\_Measurement\_Period\_SSB}$ is defined in Table 9.5.4.1-1 for FR1 and Table 9.5.4.1-2 for FR2, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- N= 8.

For FR1,

- P=$\frac{1}{1-\frac{T_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

For FR2,

- P=$\frac{1}{1-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is not overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$).
- P is $P_{sharing\ factor}$, when SSB is not overlapped with measurement gap and SSB is fully overlapped with SMTC period ($T_{SSB} = T_{SMTCperiod}$).
- P=$\frac{1}{1-\frac{T_{SSB}}{MGRP}-\frac{T_{SSB}}{T_{SMTCperiod}}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and
  - $T_{SMTCperiod} \neq$ MGRP or
  - $T_{SMTCperiod}$ = MGRP and $T_{SSB} < 0.5*T_{SMTCperiod}$
- P is $\frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MGRP}}$, when SSB is partially overlapped with measurement gap and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{SSB} = 0.5*T_{SMTCperiod}$
- P=$\frac{1}{1-\frac{T_{SSB}}{\min(T_{SMTCperiod},MGRP)}}$, when SSB is partially overlapped with measurement gap (T_{SSB} <MGRP) and SSB is partially overlapped with SMTC occasion ($T_{SSB} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.
- P is $\frac{P_{sharing\ factor}}{1-\frac{T_{SSB}}{MRGP}}$, when SSB is partially overlapped with measurement gap and SSB is fully overlapped with SMTC occasion ($T_{SSB} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)
- $P_{sharing\ factor}$ = 1, if the SSB configured for L1-RSRP measurement outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and,
  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured,

- $P_{sharing\ factor}$ = 3, otherwise.

Where:

- T_{SSB} = ssb-periodicityServingCell
- $T_{SMTCperiod}$ = the configured SMTC period

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer L1 RSRP measurement period would be expected during the period $T_{identify\_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 9.5.4.1-1: Measurement period $T_{L1-RSRP\_Measurement\_Period\_SSB}$ for FR1

Configuration	$T_{L1-RSRP\_Measurement\_Period\_SSB}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*T_{SSB})
DRX cycle ≤ 320ms	max(T_{Report}, ceil(K *M*P)*max(T_{DRX},T_{SSB}))
DRX cycle > 320ms	ceil(M*P)*T_{DRX}
Note 1: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: K = 1 when T_{SSB} ≤ 40 ms and *highSpeedMeasFlag-r16* are configured; otherwise K = 1.5.	

Table 9.5.4.1-2: Measurement period $T_{L1-RSRP\_Measurement\_Period\_SSB}$ for FR2

Configuration	$T_{L1-RSRP\_Measurement\_Period\_SSB}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P*N)*T_{SSB})
DRX cycle ≤ 320ms	max(T_{Report}, ceil(1.5*M*P*N)*max(T_{DRX},T_{SSB}))
DRX cycle > 320ms	ceil(1.5*M*P*N)*T_{DRX}
Note: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting.	

9.5.4.2 CSI-RS based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured CSI-RS resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1-RSRP\_Measurement\_Period\_CSI-RS}$.

The value of $T_{L1-RSRP\_Measurement\_Period\_CSI-RS}$ is defined in Table 9.5.4.2-1 for FR1 and in Table 9.5.4.2-2 for FR2, where

- For periodic and semi-persistent CSI-RS resources, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise
- For aperiodic CSI-RS resources M=1
- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP measurement, or

  - another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res\_per\_set}$), where $N_{res\_per\_set}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured with QCL-TypeD for all resources in the resource set.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource one RS has QCL-TypeD with

  - SSB for L1-RSRP measurement, or

  - another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res\_per\_set}$), where $N_{res\_per\_set}$ is number of resources in the resource set. The requirements apply provided TCI state is provided with QCL-TypeD for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided *qcl-info* is configured for all resources in the resource set and for each resource one RS has QCL-TypeD with

  - SSB for L1-RSRP measurement, or

  - another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements in clause 10.1.19.2 and 10.1.20.2 if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requirements apply provided *qcl-info* is configured with QCL-TypeD for all resources in the resource set.

For FR1,

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For FR2,

- P=1, when CSI-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{MGRP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is not overlapped with SMTC occasion ($T_{CSI-RS} < MGRP$)

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- $P=P_{sharing\ factor}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- P=1, when aperiodic CSI-RS resource is not overlapped with measurement gap

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{MGRP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion (TCSI-RS < $T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

- $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5*T_{SMTCperiod}$

- $P=\frac{3}{1-\frac{T_{CSI-RS}}{MGRP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5*T_{SMTCperiod}$

- $P=\frac{1}{1-\frac{T_{CSI-RS}}{\min(T_{SMTCperiod},MGRP)}}$, when CSI-RS is partially overlapped with measurement gap (T_{CSI-RS} < MGRP) and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- $P=\frac{P_{\text{sharing factor}}}{1-\frac{T_{CSI-RS}}{MGRP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

- $P_{\text{sharing factor}} = 1$, if the CSI-RS configured for L1-RSRP measurement outside measurement gap is
  - not overlapped with the SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol before each consecutive SSB symbols indicated by *SSB-ToMeasure* and 1 data symbol after each consecutive SSB symbols indicated by *SSB-ToMeasure*, given that *SSB-ToMeasure* is configured, and,
  - not overlapped with the RSSI symbols indicated by *ss-RSSI-Measurement* and 1data symbol before each RSSI symbol indicated by *ss-RSSI-Measurement* and 1 data symbol after each RSSI symbol indicated by *ss-RSSI-Measurement*, given that *ss-RSSI-Measurement* is configured

- $P_{\text{sharing factor}} = 3$, otherwise.

Where:

$T_{SMTCperiod}$ = the configured SMTC period.

T_{CSI-RS} = the periodicity of CSI-RS configured for L1-RSRP measurement

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*. $T_{SMTCperiod}$ is the shortest SMTC period among all CCs in the same FR2 band, provided the SMTC offset of all CCs in FR2 have the same offset.

Note: The overlap between CSI-RS for L1-RSRP measurement and SMTC means that CSI-RS for L1-RSRP measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For either an FR1 or FR2 serving cell, longer evaluation period would be expected during the period $T_{identify\_CGI}$ when the UE is requested to decode an NR CGI.

For either an FR1 or FR2 serving cell, longer L1 RSRP measurement period would be expected during the period $T_{identify\_CGI,E-UTRAN}$ when the UE is requested to decode an LTE CGI.

Table 9.5.4.2-1: Measurement period $T_{L1\text{-}RSRP\_Measurement\_Period\_CSI\text{-}RS}$ for FR1

Configuration	$T_{L1\text{-}RSRP\_Measurement\_Period\_CSI\text{-}RS}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320ms	max(T_{Report}, ceil(K *M*P)*max(T_{DRX},$T_{CSI\text{-}RS}$))
DRX cycle > 320ms	ceil(M*P)*T_{DRX}
Note 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3. Note 3: K = 1 when $T_{CSI\text{-}RS}$ ≤ 40 ms and *highSpeedMeasFlag-r16* are configured; otherwise K = 1.5.	

Table 9.5.4.2-2: Measurement period $T_{L1\text{-}RSRP\_Measurement\_Period\_CSI\text{-}RS}$ for FR2

Configuration	$T_{L1\text{-}RSRP\_Measurement\_Period\_CSI\text{-}RS}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P*N)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320ms	max(T_{Report}, ceil(1.5*M*P*N)*max(T_{DRX},$T_{CSI\text{-}RS}$))
DRX cycle > 320ms	ceil(M*P*N)*T_{DRX}
Note 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-RSRP measurement is transmitted with Density = 3.	

9.5.4A L1-RSRP measurement requirements (with CCA serving cell)

9.5.4A.1 SSB based L1-RSRP Reporting

The UE shall be capable of performing L1-RSRP measurements based on the configured SSB resource for L1-RSRP computation, and the UE physical layer shall be capable of reporting L1-RSRP measured over the measurement period of $T_{L1\text{-}RSRP\_Measurement\_Period\_SSB\_CCA}$.

The value of $T_{L1\text{-}RSRP\_Measurement\_Period\_SSB\_CCA}$ is defined in Table 9.5.4A.1-1 for FR1, where

- M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise

For FR1,

- P=$\frac{1}{1-\frac{T_{SSB}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the SSB; and
- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the SSB.

Where:

T_{SSB} = ssb-periodicityServingCell

$T_{SMTCperiod}$ = the configured SMTC1 period or SMTC2 period if configured

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet pervious conditions.

UE shall report RSRP_0 (Not valid) if L_1>L_{1max}.

Table 9.5.4A.1-1: Measurement period $T_{L1\text{-}RSRP\_Measurement\_Period\_SSB\_CCA}$ for FR1

Configuration	$T_{L1\text{-}RSRP\_Measurement\_Period\_SSB\_CCA}$ (ms)
non-DRX	max(T_{Report}, ceil((M+L1)*P)*T_{SSB})
DRX cycle ≤ 320ms	max(T_{Report}, ceil(1.5*(M+L1)*P)*max(T_{DRX},T_{SSB}))
DRX cycle > 320ms	ceil((M+L1)*P)*T_{DRX}
Note 1: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-RSRP measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: L1=0 if higher layer parameter timeRestrictionForChannelMeasurement is configured. Otherwise L1 is the number of SSBs not available at the UE during $T_{L1\text{-}RSRP\_Measurement\_Period\_SSB\_CCA}$ where L1 ≤ $L1_{max}$. Note 3: $L1_{max}$ =7 for Max(T_{DRX},T_{SSB}) ≤ 40ms assuming T_{DRX}=0 for non-DRX, $L1_{max}$ =5 for 40ms < Max(T_{DRX}, T_{SSB}) ≤ 320ms, $L1_{max}$ =3 for T_{DRX} > 320ms.	

9.5.5 Measurement restriction for CSI-RS and SSB for L1-RSRP measurement

The UE is required to be capable of measuring SSB and CSI-RS for L1-RSRP without measurement gaps. The UE is required to perform the SSB and CSI-RS measurements with measurement restrictions as described in the following clauses.

9.5.5.1 Measurement restriction for SSB based L1-RSRP

For FR1, when the SSB for L1-RSRP measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports simultaneousRxDataSSB-DiffNumerology, UE shall be able to measure the SSB for L1-RSRP measurement without any restriction;
  - If UE does not support simultaneousRxDataSSB-DiffNumerology, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the SSB for L1-RSRP measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for L1-RSRP measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, there is no measurement restriction allowed when the network configures mixed numerology between SSB for L1-RSRP measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the other FR2 band, provided that UE is capable of independent beam management on this FR2 band pair.

9.5.5.2 Measurement restriction for CSI-RS based L1-RSRP

For both FR1 and FR2, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD or L1-RSRP measurement, UE is not required to receive CSI-RS for L1-RSRP measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has same SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD or L1-RSRP measurement is within the active BWP and has different SCS than CSI-RS for L1-RSRP measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology* the UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS for L1-RSRP measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

For FR2, when the CSI-RS for L1-RSRP measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD or L1-RSRP measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and SSB. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS for L1-RSRP measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD or L1-RSRP measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-RSRP measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-RSRP measurement is expected, and no requirements are defined.
  - The CSI-RS for L1-RSRP measurement or the other CSI-RS in a resource set configured with repetition ON, or
  - The other CSI-RS is configured in q1 and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS for L1-RSRP measurement without any restriction.

9.5.6 Scheduling availability of UE during L1-RSRP measurement

Scheduling availability restrictions when the UE is performing L1-RSRP measurement are described in the following clauses.

9.5.6.1 Scheduling availability of UE performing L1-RSRP measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-RSRP measurement performed on SSB and CSI-RS configured as RS for L1-RSRP measurement with the same SCS as PDSCH/PDCCH in FR1.

9.5.6.2 Scheduling availability of UE performing L1-RSRP measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-RSRP measurement based on SSB as RS for L1-RSRP measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-RSRP measurement based on SSB configured for L1-RSRP measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on symbols corresponding to the SSB indexes configured for L1-RSRP measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-RSRP measurement is performed is configured.

9.5.6.3 Scheduling availability of UE performing L1-RSRP measurement on FR2

The following scheduling restriction applies due to L1-RSRP measurement.

- For the case where RS for L1-RSRP measurement is CSI-RS which is QCLed with active TCI state for PDCCH/PDSCH and not in a CSI-RS resource set with repetition ON, and N=1 applies as specified in clause 9.5.4.2
  - There are no scheduling restrictions due to L1-RSRP measurement performed based on the CSI-RS.
- Otherwise
  - The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on
    - symbols corresponding to the SSB indexes configured for L1-RSRP measurement, and/or
    - symbols corresponding to the periodic CSI-RS resource configured for L1-RSRP measurement, and/or
    - symbols corresponding to the semi-perssitent CSI-RS resource configured for L1-RSRP measurement when the resource is activated, and/or
    - symbols corresponding to the aperiodic CSI-RS resource configured for L1-RSRP measurement when the reporting is triggered.

When intra-band carrier aggregation in FR2 is performed, the scheduling restrictions on serving cell where L1-RSRP measurement is performed apply to all serving cells in the band on the symbols that fully or partially overlap with restricted symbols.

When inter-band carrier aggregation in FR2 is performed, there are no scheduling restrictions on FR2 serving cells in the bands due to L1-RSRP measurement performed on FR2 serving cell(s) in different band(s), provided that UE is capable of independent beam management on this FR2 band pair. Additionally, there is no scheduling restriction if the UE is configured with different numerology between SSB on one FR2 band and data on the other FR2 band provided the UE is configured for IBM operation for the band pair.

If following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

For the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE is expected to receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for L1-RSRP measurement; and

For the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE is expected to receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for L1-RSRP measurement.

9.5.6.4 Scheduling availability of UE performing L1-RSRP measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to L1-RSRP measurement performed on FR2 serving cell(s).

There are no scheduling restrictions on FR2 serving cell(s) due to L1-RSRP measurement performed on FR1 serving cell(s).

9.6 NE-DC: Measurements

9.6.1 Introduction

This clause contains requirements for UE supporting dual connectivity with NR PCell and E-UTRA FDD or TDD PSCell. The requirements apply to UEs that have been configured with NE-DC.

9.6.2 SFTD Measurements

9.6.2.1 Introduction

This clause contains requirements on UE capabilities for reporting of SFN and frame time difference between NR PCell and E-UTRA PSCell in RRC_CONNECTED state. The requirements comprise measurement reporting delay and measurement accuracy. The overall measurement reporting delay includes a RRC procedure delay specified in TS 38.331 [2], and the SFTD measurement reporting delay specified below.

9.6.2.2 SFTD Measurement requirements

When no DRX is used in either of the NR PCell and E-UTRA PSCell, the physical layer measurement period of the SFTD measurement shall be $T_{measure\_SFTD1}$ = max(0.2, 5 * SMTC period) s.

When DRX is used in either of the NR PCell or the E-UTRA PSCell, or in both PCell and PSCell, the physical layer measurement period ($T_{measure\_SFTD1}$) of the SFTD measurement shall be as specified in Table 9.6.2.2-1.

Table 9.6.2.2-1: SFTD measurement requirement when DRX is used

DRX cycle length (s)[Note2]	$T_{measure\_SFTD1}$ (s)
DRX cycle≤0.04	max(0.2,5 x SMTC period) (Note1)
0.04<DRX cycle≤0.32	8 x max(DRX cycle, SMTC period)
0.32<DRX cycle≤10.24	5 x DRX cycle
Note1: Number of DRX cycles depends upon the DRX cycle in use Note2: DRX cycle length in this table refers to the DRX cycle length configured for PCell or PSCell. When DRX is used in both PCell and PSCell, DRX cycle length in this table refers to the longer of the DRX cycle lengths for PCell and PSCell.	

If PSCell is changed without changing carrier frequency of PSCell while the UE is performing SFTD measurements, the UE shall still meet SFTD measurement and accuracy requirements for the new PSCell. In this case the UE shall restart the SFTD measurement, and the total physical layer measurement period shall not exceed $T_{measure\_SFTD2}$ as defined by the following expression:

$$T_{measure\_SFTD2} = (M+1)*(T_{measure\_SFTD1}) + M*T_{PSCell\_change\_NEDC}$$

where:

M is the number of times the E-UTRA PSCell is changed over the measurement period ($T_{measure\_SFTD2}$), and

$T_{PSCell\_change\_NEDC}$ is the time necessary to change the PSCell; it can be up to 25 ms.

If PCell is changed, or if PSCell is changed to a different carrier frequency, the UE shall terminate the SFTD measurement.

The measurement accuracy for the SFTD measurement when DRX is used as well as when no DRX is used shall be as specified in clause 10.1.21.1.

9.7 Cross Link Interference measurements

9.7.1 Introduction

The UE capable of performing CLI measurements shall be able to measure SRS-RSRP and CLI-RSSI which are defined in TS38.215 [4] within active DL BWP. The measurements requirements in this clause apply for TDD mode only.

CLI measurements are only applicable for RRC_CONNECTED intra-frequency:

- when SRS-RSRP measurement resource is fully confined within BW of DL active BWP
- when CLI-RSSI measurement resouce is configured within active BWP

When the UE measures SRS-RSRP and CLI-RSSI, a constant offset relative to the downlink reference timing in the serving cell shall be applied. The constant offset value is derived by UE implementation and shall be at least $Tc*N_{TA\_offset}$.

For performing CLI measurement in FR2, UE can assume the configured CLI measurement resources are QCL-ed with TypeD to one of the latest received PDSCH and the latest monitored CORESET.

CLI measurement requirements defined in clause 9.7 are applicable if

- CLI measurement is not performed on an NR carrier in the same band as E-UTRA serving carrier; and
- UE supports simultaneous Rx/Tx for inter-band CA, inter-band EN-DC, inter-band NE-DC, and NR-DC.

9.7.2 SRS-RSRP measurements

9.7.2.1 Introduction

When configured by the network, the UE shall be able to perform SRS-RSRP measurements of configured *srs-ResourceConfigCLI*. The requirements apply when the subcarrier spacing for SRS-RSRP measurement resource configuration is the same as the subcarrier spacing of the active DL BWP of serving cell. The UE is not required to measure SRS using different SCS compared to the downlink active BWP SCS of the same carrier.

9.7.2.2 Requirements applicability

The requirements in clause 9.7.2 apply, provided:

- SRS resources configured for SRS-RSRP measurements are measurable.

An SRS resource configured for SRS-RSRP shall be considered measurable when for each relevant SRS the following conditions are met:

- SRS-RSRP related side conditions given in clauses 10.1.22.1 for FR1 and FR2 for a corresponding band,
- SRS_RP and SRS Ês/Iot according to Annex B.2.7 for a corresponding band.

9.7.2.3 Measurement Reporting Requirements

The UE shall send SRS-RSRP reports only for report configurations according to *reportType* which is *cliPeriodical* or *cliEventTriggered* when SRS-RSRP report is configured.

The UE shall report the SRS-RSRP value as a 7-bit value in the range [-140, -44] dBm with 1dB step size according to clause 10.1.22.1 for FR1 and FR2.

9.7.2.3.1 Periodic Reporting

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.1.

9.7.2.3.2 Event-triggered Periodic Reporting

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.22.1.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.7.2.3.3.

9.7.2.3.3 Event Triggered Reporting

Reported SRS-RSRP measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.1.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report on.

9.7.2.4 Measurement capability

The UE shall be capable of performing SRS-RSRP measurements on the SRS resources configured for measurement, provided that the number of SRS to be monitored by UE does not exceed 8 within a slot, and the total number of SRSs to be monitored by the UE does not exceed 32.

9.7.2.5 SRS-RSRP measurement period

The UE shall be capable of performing SRS-RSRP measurement based on the configured SRS resource, and the UE shall be capable of reporting SRS-RSRP measured over measurement period of $T_{SRS\_RSRP\_measurement\_period}$ for FR1 and FR2.

Table 9.7.2.5-1 Measurement period $T_{SRS\_RSRP\_measurement\_period}$

Configuration	$T_{SRS\_measurement\_period}$ (ms)
No DRX	Max(60, 3 X T_{SRS})
DRX cycle ≤ 320ms	Max(60, Ceil(1.5 X 3) X max(T_{SRS}, T_{DRX}))
DRX cycle > 320ms	3 X T_{DRX}
Note: T_{SRS} is SRS measurement periodicity configured *SRS-PeriodicityAndOffset*, and T_{DRX} is the DRX cycle length.	

If the SRS resources configured for measurement are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for $T_{SRS\_RSRP\_measurement\_period}$.

9.7.3 CLI-RSSI measurements

9.7.3.1 Introduction

When configured by the network, the UE shall be able to perform CLI-RSSI measurement of configured *rssi-ResourceConfigCLI*. The subcarrier spacing for CLI-RSSI measurement resource configuration can be same or different from the subcarrier spacing of active BWP. UE shall perform CLI-RSSI measurement with the SCS of the active BWP.

9.7.3.2 Requirements applicability

The requirements in clause 9.7.3 apply, provided:

- The measurement resources configured for CLI-RSSI measurements are measurable.

A measurement resource configured for CLI-RSSI shall be considered measurable when for each relevant CLI-RSSI resource the following conditions are met:

- CLI-RSSI related side conditions given in clauses 10.1.22.2 for FR1 and FR2 for a corresponding band.

9.7.3.3 Measurement Reporting Requirements

The UE shall send CLI-RSSI reports only for report configurations according to *reportType* which is *cliPeriodical* or *cliEventTriggered* when CLI-RSSI report is configured.

The UE shall report the CLI-RSSI value as a 7-bit value in the range [-100, -25] dBm with 1dB step size according to clause 10.1.22.2 for FR1 and FR2.

9.7.3.3.1 Periodic Reporting

Reported CLI-RSSI measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.2.

9.7.3.3.2 Event-triggered Periodic Reporting

Reported CLI-RSSI measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.22.2.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.7.3.3.3.

9.7.3.3.3 Event Triggered Reporting

Reported CLI-RSSI measurements contained in periodically triggered measurement reports shall meet the requirements in clause 10.1.22.2.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report on.

9.7.3.4 Measurement capability

The UE should be capable of performing CLI-RSSI measurement based on the configured resource, provided that the maximum number of CLI-RSSI measurement resources for the UE does not exceed 64.

9.7.3.5 CLI-RSSI measurement period

The UE shall be capable of performing CLI-RSSI measurement based on the configured measurement resource within $T_{CLI\_RSSI\_measurement\_period}$. The UE shall be able to provide a single RSSI sample for each measurement resource configured for CLI-RSSI measurement occurring with a configured periodicity. The CLI-RSSI measurement period $T_{CLI\_RSSI\_measurement\_period}$ corresponds to the CLI-RSSI measurement resource periodicity, which is configured for by higher layers via *RSSI-PeriodicityAndOffset*.

If the CLI-RSSI measurement resources configured for measurement are partially or fully overlapping with SMTC window, SSB or CSI-RS configured for RLM, BFD, CBD or L1-RSRP measurement or measurement gaps, requirements are not specified for $T_{CLI\_RSSI\_measurement\_period}$.

9.7.4 Scheduling availability of UE during CLI measurements

Scheduling availability restrictions when the UE is performing CLI measurements which are SRS-RSRP and CLI-RSSI are described in the following clause.

9.7.4.1 Scheduling availability of UE performing measurement on FR1

The following scheduling restriction applies due to CLI measurements.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs CLI measurements, and on 1 data symbol before an OFDM symbol used for CLI measurements for 15 kHz and 30 kHz subcarrier spacing.
- For the UE which does not support *cli-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs SRS-RSRP measurements, and on 1 data symbol before an OFDM symbol used for SRS-RSRP measurements for 15 kHz and 30 kHz subcarrier spacing.
- For the UE which does not support *cli-RSSI-FDM-DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs CLI-RSSI measurements, and on 1 data symbol before an OFDM symbol used for CLI-RSSI measurements for 15 kHz and 30 kHz subcarrier spacing.
- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs CLI measurement, and on 2 data symbols before an OFDM symbol used for CLI measurements for 60 kHz subcarrier spacing.
- For the UE which does not support *cli-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs SRS-RSRP measurement, and on 2 data symbols before an OFDM symbol used for SRS-RSRP measurements for 60 kHz subcarrier spacing.
- For the UE which does not support *cli-RSSI-FDM-DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs CLI-RSSI measurement, and on 2 data symbols before an OFDM symbol used for CLI-RSSI measurements for 60 kHz subcarrier spacing.

When TDD intra-band carrier aggregation is configured, the scheduling restrictions on serving cell where CLI measurements are performed apply on all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

9.7.4.2 Scheduling availability of UE performing measurement on FR2

The following scheduling restriction applies due to CLI measurements.

- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs CLI measurements, and on 1 data symbol before an OFDM symbol used for CLI measurements for 60 kHz subcarrier spacing.
- For the UE which does not support *cli-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs SRS-RSRP measurements, and on 1 data symbol before an OFDM symbol used for SRS-RSRP measurements for 60 kHz subcarrier spacing.
- For the UE which does not support *cli-RSSI-FDM-DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs CLI-RSSI measurements, and on 1 data symbol before an OFDM symbol used for CLI-RSSI measurements for 60 kHz subcarrier spacing.
- The UE is not expected to transmit PUCCH/PUSCH/SRS on OFDM symbols on which the UE performs CLI measurements, and on 2 data symbols before an OFDM symbol used for CLI measurements for 120 kHz subcarrier spacing.

- For the UE which does not support *cli-SRS-RSRP-FDM_DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs SRS-RSRP measurements, and on 2 data symbols before an OFDM symbol used for SRS-RSRP measurements for 120 kHz subcarrier spacing.

- For the UE which does not support *cli-RSSI-FDM-DL*, the UE is not expected to receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on OFDM symbols on which the UE performs CLI-RSSI measurements, and on 2 data symbols before an OFDM symbol used for CLI-RSSI measurements for 120 kHz subcarrier spacing.

When TDD intra-band carrier aggregation is configured, the scheduling restrictions on serving cell where CLI measurements are performed apply on all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols.

9.8 L1-SINR measurements for Reporting

9.8.1 Introduction

When configured by the network, the UE shall be able to perform L1-SINR measurements with the measurement resources configured as the selection of:

- CSI-RS based CMR and no dedicated IMR configured;

- SSB based CMR and dedicated IMR configured;

- CSI-RS based CMR and dedicated IMR configured.

The measurements shall be performed for a serving cell, including PCell, PSCell, or SCell, on the resources configured for L1-SINR measurements within the active BWP.

The UE shall be able to measure all CSI-RS resources and/or SSB resources and/or CSI-IM resources of the *nzp-CSI-RS-ResourceSet* and/or *csi-SSB-ResourceSet and/or CSI-IM-ResourceSet* within the *CSI-ResourceConfig* settings for L1-SINR for the active BWP and measure interference on corresponding NZP CSI-RS or CSI-IM resources if configured, provided that the number of resources does not exceed the UE capability indicated by *beamManagementSSB-CSI-RS*.

The UE shall report the measurement quantity (*reportQuantity*) and send periodic, semi-persistent or aperiodic reports, according to the *reportConfigType* according to the CSI reporting configuration(s) (*CSI-ReportConfig*) for the active BWP.

9.8.2 Requirements applicability

The requirements in clause 9.8 apply, provided:

- CMR resources configured for L1-SINR measurements are measurable, and

- NZP-IMR resources configured for L1-SINR measurements if applicable are measurable.

Requirements are defined for periodic, semi-persistent and aperiodic resources.

9.8.3 Measurement Reporting Requirements

The UE shall send L1-SINR reports only for report configurations configured for the active BWP.

The UE shall report the L1-SINR value as a 7-bit value in the range [-23, 40] dB with 0.5dB step size if *nrofReportedRS* is configured to one. If *nrofReportedRS* is configured to be larger than one, or if *groupBasedBeamReporting* is enabled, the UE shall use differential L1-SINR based reporting. The differential L1-SINR is quantized to a 4-bit value with 1dB step size. The mapping between the reported L1-SINR value and the measured quantity is described in 10.1.16.

9.8.3.1 Periodic Reporting

The UE shall transmit the periodic L1-SINR reporting on PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.8.3.2 Semi-Persistent Reporting

The UE shall only send semi-persistent L1-SINR measurement reports on PUSCH, if a DCI for triggering report has been received.

The UE shall only send semi-persistent L1-SINR measurement reports on PUCCH, if an activation command as described in clause 6.1.3.16 in TS38.321 [7] has been received.

The UE shall transmit the semi-persistent L1-SINR reporting on PUSCH or PUCCH over the air interface according to the periodicity defined in clause 5.2.1.4 in TS 38.214 [26].

9.8.3.3 Aperiodic Reporting

The UE shall only send aperiodic L1-RSRP measurement reports, if a DCI for triggering report has been received.

After the UE receives CSI request in DCI, the UE shall transmit the aperiodic L1-RSRP reporting on PUSCH over the air interface at the time specified according to clause 5.2.1.4 in TS 38.214 [26].

9.8.4 L1-SINR measurement requirements

9.8.4.1 L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and no dedicated resource configured as IMR for L1-SINR computation, and the UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1\text{-}SINR\_Measurement\_Period\_CSI\text{-}RS\_CMR\_Only}$.

The value of $T_{L1\text{-}SINR\_Measurement\_Period\_CSI\text{-}RS\_CMR\_Only}$ is defined in Table 9.8.4.1-1 for FR1 and in Table 9.8.4.1-2 for FR2, where for the value of M,

- For periodic and semi-persistent CSI-RS resources as CMR, M=1 if higher layer parameter *timeRestrictionForChannelMeasurement* is configured, and M=3 otherwise;
- For aperiodic CSI-RS resources as CMR, M=1.

For the value of N as RX beamforming scaling factor in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with
  - SSB for L1-RSRP or L1-SINR measurement, or
  - another CSI-RS in resource set configured with repetition ON.
- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res\_per\_set}$), where $N_{res\_per\_set}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.
- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with
  - SSB for L1-RSRP or L1-SINR measurement, or
  - another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res\_per\_set}$), where $N_{res\_per\_set}$ is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requriements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with

  - SSB for L1-RSRP or L1-SINR measurement, or

  - another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requriements apply provided *qcl-info* is configured for all resources in the resource set.

For the value of P as sharinig factor in FR1,

- P=$\frac{1}{1-\frac{T_{CSI-RS}}{MRGP}}$, when in the monitored cell there are measurement gaps configured for intra-frequency, inter-frequency or inter-RAT measurements, which are overlapping with some but not all occasions of the CSI-RS; and

- P=1 when in the monitored cell there are no measurement gaps overlapping with any occasion of the CSI-RS.

For the value of P as sharing factor in FR2,

- P=1, when CSI-RS is not overlapped with measurement gap and also not overlapped with SMTC occasion.

- P=$\frac{1}{1-\frac{T_{CSI-RS}}{MRGP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is not overlapped with SMTC occasion (T_{CSI-RS} < MGRP)

- P=$\frac{1}{1-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is not overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$).

- P=3, when CSI-RS is not overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$).

- P= $\frac{1}{1-\frac{T_{CSI-RS}}{MRGP}-\frac{T_{CSI-RS}}{T_{SMTCperiod}}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and

  - $T_{SMTCperiod} \neq$ MGRP or

  - $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} < 0.5*T_{SMTCperiod}$

- P=$\frac{3}{1-\frac{T_{CSI-RS}}{MRGP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is not overlapped with measurement gap and $T_{SMTCperiod}$ = MGRP and $T_{CSI-RS} = 0.5*T_{SMTCperiod}$

- P= $\frac{1}{1-\frac{T_{CSI-RS}}{\min(T_{SMTCperiod},MGRP)}}$, when CSI-RS is partially overlapped with measurement gap (T_{CSI-RS} < MGRP) and CSI-RS is partially overlapped with SMTC occasion ($T_{CSI-RS} < T_{SMTCperiod}$) and SMTC occasion is partially or fully overlapped with measurement gap.

- P=$\frac{3}{1-\frac{T_{CSI-RS}}{MRGP}}$, when CSI-RS is partially overlapped with measurement gap and CSI-RS is fully overlapped with SMTC occasion ($T_{CSI-RS} = T_{SMTCperiod}$) and SMTC occasion is partially overlapped with measurement gap ($T_{SMTCperiod}$ < MGRP)

Where:

$T_{SMTCperiod}$ = the configured SMTC1 period or SMTC2 period if configured.

T_{CSI-RS} = the periodicity of CSI-RS configured for L1-SINR measurement

If the high layer in TS 38.331 [2] signaling of *smtc2* is configured, $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc2*; Otherwise $T_{SMTCperiod}$ corresponds to the value of higher layer parameter *smtc1*.

Note: The overlap between CSI-RS for L1-SINR measurement and SMTC means that CSI-RS for L1-SINR measurement is within the SMTC window duration.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

Table 9.8.4.1-1: Measurement period $T_{L1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only}$ for FR1

Configuration	$T_{L1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*T_{CSI-RS})
DRX cycle ≤ 320ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},T_{CSI-RS}))
DRX cycle > 320ms	ceil(M*P)*T_{DRX}
Note 1: T_{CSI-RS} is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.	

Table 9.8.4.1-2: Measurement period $T_{L1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only}$ for FR2

Configuration	$T_{L1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_Only}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P*N)*T_{CSI-RS})
DRX cycle ≤ 320ms	max(T_{Report}, ceil(1.5*M*P*N)*max(T_{DRX},T_{CSI-RS}))
DRX cycle > 320ms	ceil(M*P*N)*T_{DRX}
Note 1: T_{CSI-RS} is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3.	

9.8.4.2 L1-SINR reporting with SSB based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the SSB configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to SSB configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR}$.

The value of $T_{L1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR}$ is defined in Table 9.8.4.2-1 for FR1 and in Table 9.8.4.2-2 for FR2, where for the value of M

- For periodic or semi-persistent NZP CSI-RS or CSI-IM resource as dedicated IMR, M=1 if the higher layer parameters *timeRestrictionForChannelMeasurements* and/or *timeRestrictionForInterferenceMeasurements* are configured, and M=3 otherwise;

- For aperiodic NZP-CSI-RS or CSI-IM resource as dedicated IMR, M=1.

For the value of N as RX beamforming scaling factor in FR2

- N = 8.

- As the sharing factor, P is defined as the maximum value between P_{CMR} and P_{IMR}, i.e., P = max(P_{CMR}, P_{IMR}), where

- the value of P_{CMR} shall be derived in the same way as the sharing factor P for SSB based L1-RSRP measurement in clause 9.5.4.1, in which the occasions and period of the SSB for CMR shall be used instead.

- the value of P_{IMR} shall be derived in the same way as the sharing factor P for CSI-RS based L1-RSRP measurement in clause 9.5.4.2, in which the occasions and period of the NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead.

Longer evaluation period would be expected if the combination of SSB, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For L1-SINR measurement with SSB as CMR and CSI-RS or CSI-IM as IMR, the requirement shall apply if the CSI-RS is configured as IMR with repetition field as “repetition = OFF” or CSI-IM is configured as IMR.

For L1-SINR measurement with SSB as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if SSB occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap.

Table 9.8.4.2-1: Measurement period $T_{L1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR}$ for FR1

Configuration	$T_{L1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*T_{SSB})
DRX cycle ≤ 320ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},T_{SSB}))
DRX cycle > 320ms	ceil(M*P)*T_{DRX}
Note 1: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR channel measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.	

Table 9.8.4.2-2: Measurement period $T_{L1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR}$ for FR2

Configuration	$T_{L1-SINR\_Measurement\_Period\_SSB\_CMR\_IMR}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P*N)*T_{SSB})
DRX cycle ≤ 320ms	max(T_{Report}, ceil(1.5*M*P*N)*max(T_{DRX},T_{SSB}))
DRX cycle > 320ms	ceil(1.5*M*P*N)*T_{DRX}
Note 1: T_{SSB} = ssb-periodicityServingCell is the periodicity of the SSB-Index configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to SSB configured for channel measurement, with the same periodicity.	

9.8.4.3 L1-SINR reporting with CSI-RS based CMR and dedicated IMR configured

The UE shall be capable of performing L1-SINR measurements with the CSI-RS resource configured as CMR and dedicated resource configured as IMR for L1-SINR computation, in which the NZP-CSI-RS or CSI-IM resource configured as dedicated IMR shall be 1-to-1 mapped to CSI-RS resource configured as CMR, with the same periodicity. The UE physical layer shall be capable of reporting L1-SINR measured over the measurement period of $T_{L1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR}$.

The value of $T_{L1-SINR\_Measurement\_Period\_CSI-RS\_CMR\_IMR}$ is defined in Table 9.8.4.3-1 for FR1 and in Table 9.8.4.3-2 for FR2, where for the value of M,

- M=1 shall be applied if
    - aperiodic NZP-CSI-RS as CMR or dedicated IMR, or
    - aperiodic CSI-IMR as dedicated IMR, or
    - periodic and semi-persistent NZP-CSI-RS as CMR or dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured, or

  - periodic and semi-persistent CSI-IM as dedicated IMR and the higher layer parameters *timeRestrictionForChannelMeasurement* and/or *timeRestrictionForInterferenceMeasurements* are configured;

- M=3 otherwise.

For the value of N as RX beamforming scaling factor in FR2

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply if *qcl-InfoPeriodicCSI-RS* is configured for all the resources in the resource set and for each resource one RS has QCL-TypeD with

  - SSB for L1-RSRP or L1-SINR measurement, or

  - another CSI-RS in resource set configured with repetition ON.

- For periodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res\_per\_set}$), where $N_{res\_per\_set}$ is number of resources in the resource set. The requirements apply provided *qcl-InfoPeriodicCSI-RS* is configured for all resources in the resource set.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set and for each resource has QCL-TypeD with

  - SSB for L1-RSRP or L1-SINR measurement, or

  - another CSI-RS in resource set configured with repetition ON.

- For semi-persistent CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=ceil(*maxNumberRxBeam* / $N_{res\_per\_set}$), where $N_{res\_per\_set}$ is number of resources in the resource set. The requirements apply provided TCI state is provided for all resources in the resource set in the MAC CE activating the resource set.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to OFF, N=1. The requriements apply provided *qcl-info* is configured for all resources in the resource set and for each resource has QCL-TypeD with

  - SSB for L1-RSRP or L1-SINR measurement, or

  - another CSI-RS in resource set configured with repetition ON.

- For aperiodic CSI-RS resources as CMR in a resource set configured with higher layer parameter *repetition* set to ON, N=1. UE is not required to meet the accuracy requirements if number of resources in the resource set is smaller than *maxNumberRxBeam*. The requriements apply provided *qcl-info* is configured for all resources in the resource set.

As the sharing factor, P is defined as the maximum value between P_{CMR} and P_{IMR}, i.e., P = max(P_{CMR}, P_{IMR}), where

- the value of P_{CMR} and P_{IMR} shall be derived in the same way as the sharing factor P for CSI-RS based L1-RSRP measurement in clause 9.5.4.2, in which the occasions and period of the CSI-RS for CMR and NZP CSI-RS for NZP-IMR or CSI-IM for ZP-IMR shall be used instead respectively.

Longer evaluation period would be expected if the combination of CSI-RS, SMTC occasion and measurement gap configurations does not meet pervious conditions.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS as IMR, the requirement shall apply only if CSI-RS resources as CMR and IMR are configured with the same repetition field and the number of CSI-RS resources in the resource sets for CMR and IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-IM as IMR, the requirement shall apply only if the number of CSI-RS resources in the resource set for CMR and the number of CSI-IM resources in the resource set for IMR are same.

For L1-SINR measurement with CSI-RS as CMR and CSI-RS/CSI-IM as IMR, no requirement shall apply if CSI-RS occasions for CMR or CSI-RS/CSI-IM occasions for IMR are fully overlapped with the configured measurement gap.

Table 9.8.4.3-1: Measurement period $T_{L1\text{-}SINR\_Measurement\_Period\_CSI\text{-}RS\_CMR\_IMR}$ for FR1

Configuration	$T_{L1\text{-}SINR\_Measurement\_Period\_CSI\text{-}RS\_CMR\_IMR}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320ms	max(T_{Report}, ceil(1.5*M*P)*max(T_{DRX},$T_{CSI\text{-}RS}$))
DRX cycle > 320ms	ceil(M*P)*T_{DRX}
Note 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3. Note 3: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.	

Table 9.8.4.3-2: Measurement period $T_{L1\text{-}SINR\_Measurement\_Period\_CSI\text{-}RS\_CMR\_IMR}$ for FR2

Configuration	$T_{L1\text{-}SINR\_Measurement\_Period\_CSI\text{-}RS\_CMR\_IMR}$ (ms)
non-DRX	max(T_{Report}, ceil(M*P*N)*$T_{CSI\text{-}RS}$)
DRX cycle ≤ 320ms	max(T_{Report}, ceil(1.5*M*P*N)*max(T_{DRX},$T_{CSI\text{-}RS}$))
DRX cycle > 320ms	ceil(M*P*N)*T_{DRX}
Note 1: $T_{CSI\text{-}RS}$ is the periodicity of CSI-RS configured for L1-SINR measurement. T_{DRX} is the DRX cycle length. T_{Report} is configured periodicity for reporting. Note 2: the requirements are applicable provided that the CSI-RS resource configured for L1-SINR measurement is transmitted with Density = 3. Note 3: The requirements are applicable provided that the CSI-RS resource configured for interference measurement shall be 1-to-1 mapped to CSI-RS configured for channel measurement, with the same periodicity.	

9.8.5 Measurement restriction for L1-SINR measurement

The UE is required to be capable of measuring L1-SINR without measurement gaps. The UE is required to perform the SSB and CSI-RS/CSI-IM measurements with measurement restrictions as described in the following clauses.

9.8.5.1 Measurement restriction if SSB configured for L1-SINR Measurement

For FR1, when the SSB configured as CMR for L1-SINR measurement is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement,

- If SSB and CSI-RS have same SCS, UE shall be able to measure the SSB for L1-SINR measurement without any restriction;
- If SSB and CSI-RS have different SCS,
  - If UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to measure the SSB for L1-SINR measurement without any restriction;
  - If UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both SSB for L1-SINR measurement and CSI-RS. Longer measurement period for SSB based L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the SSB configured as CMR for L1-SINR measurement on one CC is in the same OFDM symbol as CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, UE is required to measure one of but not both SSB for L1-SINR measurement and CSI-RS. Longer measurement period for SSB based L1-RSRP measurement is expected, and no requirements are defined.

For FR2, there is no measurement restriction allowed when the network configures mixed numerology between SSB configured as CMR for L1-SINR measurement on one FR2 band and CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-

SINR measurement on the other FR2 band, provided that UE is capable of independent beam management on this FR2 band pair.

9.8.5.2 Measurement restriction if CSI-RS configured for L1-SINR measurement

For both FR1 and FR2, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to receive CSI-RS for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR1, when the SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement is within the active BWP and has same SCS than CSI-RS configured for L1-SINR measurement, the UE shall be able to perform CSI-RS measurement without restrictions.

For FR1, when the SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement is within the active BWP and has different SCS than CSI-RS configured for L1-SINR measurement, the UE shall be able to perform CSI-RS measurement with restrictions according to its capabilities:

- If the UE supports *simultaneousRxDataSSB-DiffNumerology*, UE shall be able to perform CSI-RS measurement without restrictions.
- If the UE does not support *simultaneousRxDataSSB-DiffNumerology*, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR1, when the CSI-RS configured for L1-SINR measurement is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE shall be able to measure the CSI-RS for L1-SINR measurement without any restriction.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and SSB. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-RS configured for L1-SINR measurement on one CC is in the same OFDM symbol as another CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-RS for L1-SINR measurement and the other CSI-RS. Longer measurement period for CSI-RS based L1-SINR measurement is expected, and no requirements are defined.
  - The CSI-RS for L1-SINR measurement or the other CSI-RS in a resource set configured with repetition ON, or
  - The CSI-RS or the other CSI-RS is configured as dedicated IMR for L1-SINR computation with SSB as CMR, or
  - The other CSI-RS is configured in q1 and beam failure is detected, or
  - The two CSI-RS-es are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-RS configured for L1-SINR measurement without any restriction.

9.8.5.3 Measurement restriction if CSI-IM configured for L1-SINR measurement

For both FR1 and FR2, when the CSI-IM configured for L1-SINR measurement is in the same OFDM symbol as SSB for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement, UE is not required to measure CSI-IM for L1-SINR measurement in the PRBs that overlap with an SSB.

For FR1, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as SSB for RLM, BFD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band, or in the same symbol as SSB for CBD measurement on the same CC or different CCs in the same band when beam failure is detected, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and SSB. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.

For FR2, when the CSI-IM configured for L1-SINR measurement on one CC is in the same OFDM symbol as the CSI-RS for RLM, BFD, CBD, L1-RSRP or L1-SINR measurement on the same CC or different CCs in the same band,

- In the following cases, UE is required to measure one of but not both CSI-IM for L1-SINR measurement and CSI-RS. Longer measurement period for L1-SINR measurement is expected, and no requirements are defined.
    - The CSI-RS in a resource set configured with repetition ON, or
    - The CSI-RS is configured in q1 and beam failure is detected, or
    - The CMR for L1-SINR measurement and the CSI-RS are not QCL-ed w.r.t. QCL-TypeD, or the QCL information is not known to UE,
- Otherwise, UE shall be able to measure the CSI-IM configured for L1-SINR measurement without any restriction.

9.8.6 Scheduling availability of UE during L1-SINR measurement

Scheduling availability restrictions when the UE is performing L1-SINR measurement are described in the following clauses.

9.8.6.1 Scheduling availability of UE performing L1-SINR measurement with a same subcarrier spacing as PDSCH/PDCCH on FR1

There are no scheduling restrictions due to L1-SINR measurement performed on SSB and CSI-RS configured for L1-SINR measurement with the same SCS as PDSCH/PDCCH in FR1.

9.8.6.2 Scheduling availability of UE performing L1-SINR measurement with a different subcarrier spacing than PDSCH/PDCCH on FR1

For UEs which support *simultaneousRxDataSSB-DiffNumerology* [14] there are no restrictions on scheduling availability due to L1-SINR measurement based on SSB configured for L1-SINR measurement. For UEs which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to L1-SINR measurement based on SSB configured for L1-SINR measurement.

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking /CSI-RS for CQI on SSB symbols to be measured for L1-SINR measurement.

When intra-band carrier aggregation in FR1 is configured, the scheduling restrictions on serving cell where L1-SINR measurement is performed apply to all serving cells in the same band on the symbols that fully or partially overlap with restricted symbols. When inter-band carrier aggregation within FR1 is configured, there are no scheduling restrictions on FR1 serving cell(s) configured in other bands than the bands in which the serving cell where L1-SINR measurement is performed is configured.

9.8.6.3 Scheduling availability of UE performing L1-SINR measurement on FR2

The following scheduling restriction applies due to L1-SINR measurement.

- For the cases of CSI-RS used for L1-SINR measurement of CSI-RS based CMR only case and CSI-RS based CMR plus CSI-RS based ZP-IMR/NZP-IMR case and CSI-RS based CMR plus ZP-IMR case, where CSI-RS is QCLed with active TCI state for PDCCH/PDSCH and not in a CSI-RS resource set with repetition ON, and N=1 applies as specified in clause 9.8.4
    - There are no scheduling restrictions due to L1-SINR measurement performed based on the CSI-RS.
- Otherwise

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on the CSI-RS for L1-RSRP measurement symbols to be measured for L1-SINR.

When intra-band carrier aggregation is performed, the scheduling restrictions on serving cell where L1-SINR measurement is performed apply to all serving cells in the band on the symbols that fully or partially overlap with restricted symbols.

If following conditions are met,

- UE has been notified about system information update through paging,
- The gap between UE's reception of PDCCH that UE monitors in the Type 2-PDCCH CSS set and that notifies system information update, and the PDCCH that UE monitors in the Type0-PDCCH CSS set, is greater than 2 slots,

for the SSB and CORESET for RMSI scheduling multiplexing patterns 3, UE is expected to receive the PDCCH that UE monitors in the Type0-PDCCH CSS set, and the corresponding PDSCH, on SSB symbols to be measured for L1-SINR measurement; and

for the SSB and CORESET for RMSI scheduling multiplexing patterns 2, UE is expected to receive PDSCH that corresponds to the PDCCH that UE monitors in the Type0-PDCCH CSS set, on SSB symbols to be measured for L1-SINR measurement.

9.8.6.4 Scheduling availability of UE performing L1-SINR measurement on FR1 or FR2 in case of FR1-FR2 inter-band CA

There are no scheduling restrictions on FR1 serving cell(s) due to L1-SINR measurement performed on FR2 serving cell(s).

There are no scheduling restrictions on FR2 serving cell(s) due to L1-SINR measurement performed on FR1 serving cell(s).

9.9 NR measurements for positioning

9.9.1 Introduction

This clause contains requirements for UE capable of performing NR positioning measurements defined in TS 38.215 [4], including RSTD, PRS-RSRP, UE Rx-Tx time difference, and NR E-CID measurements.

For RSTD, PRS-RSRP and UE Rx-Tx time difference measurements, the requirements in clauses 9.9.2, 9.9.3 and 9.9.4 apply provided:

- UE is configured with measurement gaps
- No active BWP switching occurs during the measurement gaps for PRS measurement, and

All measurement requirements specified in clause 9.9.2, 9.9.3 and 9.9.4 shall apply without DRX as well as for any DRX configuration specified in TS 38.331 [2].

UE is not required to perform additional SSB measurement for the SSB configured as QCL source of PRS resources.

9.9.2 RSTD measurements

9.9.2.1 Introduction

The requirements in clause 9.9.2 shall apply provided the UE has received *NR-DL-TDOA-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure and report DL RSTD measurements defined in TS 38.215 [4].

9.9.2.2 Requirements Applicability

The requirements in clause 9.9.2 apply for periodic and triggered RSTD measurements, provided:

- PRS-RSTD related side conditions given in clause 10.1.23 for FR1 and FR2 are fulfilled, for a corresponding Band.

9.9.2.3 Measurement Capability

UE PRS RSTD measurement capability is as indicated by the UE in *NR-DL-TDOA-ProvideCapabilities*, according to TS 37.355[34].

9.9.2.4 Measurement Reporting Requirements

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported RSTD measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.23.3.

The RSTD measurements performed and reported according to this section shall meet the RSTD measurement accuracy requirements in clause 10.1.25, for each measured DL PRS resource.

9.9.2.4.1 Void

9.9.2.4.2 Void

9.9.2.4.3 Void

9.9.2.5 Measurements Period Requirements

When physical layer receives last of *NR-TDOA-ProvideAssistanceData* message and *NR-TDOA-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.2.3) DL RSTD measurements, defined in TS 38.215 [4], within the measurement period during $T_{RSTD,Total}$ defined further in this clause.

When measurement gaps and processing time T have overlap between different positioning frequency layers, $T_{RSTD,Total}$ is defined as:

$$\mathrm{T_{RSTD,Total}} = \sum_{\mathrm{i=1}}^{\mathrm{L}} \mathrm{T_{RSTD,i}} + (\mathrm{L}-1) * \max\left(\mathrm{T_{effect,i}}\right)$$

Where ,

i is the index of positioning frequency layer,

L is total number of positioning frequency layers, and $\mathrm{T}_{\mathrm{effect},i}$ is the periodicity of PRS-RSTD measurement in positioning frequency layer i as defined further in this clause.

Editor’s note: FFS the RSTD measurement period when measurement gaps and processing time T do not have overlap between different positioning frequency layers.

$\mathrm{T_{PRS-RSTD,i}}$ is the measurement period for PRS RSTD measurement inpositioning frequency layer *i* as specified below:

$$\mathrm{T_{PRS-RSTD,i}} = \left(\mathrm{CSSF_{PRS,i}} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,\mathrm{i}}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{PRS,\mathrm{i}}}{N} \right\rceil * N_{sample} - 1\right) * \mathrm{T_{effect,i}} + \mathrm{T_{last}} ,$$

where:

$N_{RxBeam,i}$ is the UE Rx beam sweeping factor. In FR1, $N_{RxBeam,i}$ = 1; and in FR2 $N_{RxBeam,i}$ = [8].

$CSSF_{PRS,i}$ is the carrier-specific scaling factor for NR PRS-based based positioning measurements in frequency layer i as defined in clause 9.1.5.2 as $CSSF_{within\_gap,i}$.

N_{sample} is the number of PRS RSTD samples and N_{sample}= [4].

T_{last} is the measurement duration for the last PRS RSTD sample, including the sampling time and processing time, $T_{last} = T_i + L_{PRS,i}$,

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available\_PRS,i}} \right\rceil * T_{available\_PRS,i}$$

T_i corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

$T_{available\_PRS,i} = LCM(T_{PRS,i}, MGRP_i)$, the least common multiple between $T_{PRS,i}$ and $MGRP_i$.

$T_{PRS,i}$ is the periodicity of DL PRS resource on frequency layer *i*.

$L_{PRS,i}$ is the time duration as defined in clause 5.1.6.5 of TS 38.214 [26, 5.1.6.5].

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources in positioning frequency layer *i* configured in a slot.

$\{N, T\}$ is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34].

N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* specified in TS 37.355 [34].

If positioning frequency layer *i* has more than one DL PRS resource set with different PRS periodicities, the maximum PRS periodicity among DL PRS resource sets is used to derive the measurement period of that positioning frequency layer.

If handover occurs while RSTD measurements are being performed, then the UE shall continue and complete the on-going RSTD measurements. The UE shall also meet the RSTD measurement requirements in this clause and measurement accuracy requirements in clause 10.1.23. However, in this case the RSTD measurement period $T_{RSTD,total.HO}$ shall be as follows:

$$T_{RSTD,total,HO} = T_{RSTD,Total} + K * T_{effect} + T_{HO}$$

Where,

- K is the number of times handover occurs during $T_{PRS-RSRP,total.HO}$;
- T_{effect} is the largest $T_{effect,i}$ among all PRS layers;
- T_{HO} is the time during which the RSTD measurement may not be possible due to handover; it can be up to $T_{interrupt}$ as defined in clause 6.1.

9.9.2.6 Void

9.9.3 PRS-RSRP measurements

9.9.3.1 Introduction

The requirements in clause 9.9.3.5 shall apply provided the UE has received a message from LMF via LPP [34] requesting the UE to measure and report PRS-RSRP measurements defined in TS 38.215 [4].

9.9.3.2 Requirements applicability

The requirements in clause 9.9.3 apply for periodic and triggered PRS-RSRP measurements, provided:

- PRS-RSRP related side conditions given in clause 10.1.24 are met for a corresponding Band.

9.9.3.3 Measurement Capability

UE PRS-RSRP measurement capability is as indicated by the UE in *NR-DL-AoD-ProvideCapabilities* according to TS 37.355 [34].

9.9.3.4 Measurement Reporting Requirements

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported PRS-RSRP measurement values contained in measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.24.3.

The PRS-RSRP measurement accuracy for all measured PRS resources shall be fulfilled according to the accuracy requriements specified in the clauses 10.1.24.

9.9.3.5 Measurement Period Requirements

When the physical layer receives *NR-DL-AoD-ProvideAssistanceData* message and *NR-DL-AoD-RequestLocationInformation* message from LMF via LPP [34], the UE shall be able to measure multiple (up to the UE capability specified in Clause 9.9.3.3) PRS-RSRP measurements, defined in TS 38.215 [4], from configured PRS resources for configured TRPs on configured PRS frequency layers, within $\mathrm{T_{PRS-RSRP,total}}$ ms.

If measurement gaps and processing time T have overlap between different frequency positioning frequency layers,

$$\mathrm{T_{PRS-RSRP,\,total}} = \sum_{i=1}^{L} \mathrm{T_{PRS-RSRP,i}} + (L-1) * \max\left(\mathrm{T}_{\mathrm{effect},i}\right)$$

Editor's note: FFS the PRS-RSRP measurement period when measurement gaps and processing time T do not have overlap between different positioning frequency layers.

where i is the index of PRS frequency layer,

$\mathrm{T_{PRS-RSRP,i}}$ is the measurement period for PRS-RSRP measurements in frequency layer i as defined further in this clause,

L is total number of positioning frequency layers, and $\mathrm{T}_{\mathrm{effect},i}$ is the periodicity of PRS-RSRP measurement in frequency layer i as defined further in this clause.

$$\mathrm{T_{PRS-RSRP,i}} = \left(\mathrm{CSSF_i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,\mathrm{i}}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{PRS,\mathrm{i}}}{N} \right\rceil * N_{sample} - 1\right) * \mathrm{T_{effect,i}} + \mathrm{T_{last}}$$

where

$\mathrm{CSSF_i}$ is the carrier specific scaling factor for PRS-RSRP measurements specified in clause 9.1.5.2,$N_{RxBeam,i}$ is $\mathrm{CSSF_i}$ is the carrier specific scaling factor for NR PRS-based measurements specified in clause 9.1.5.2 as $\mathrm{CSSF_{within\_gap,i}}$,

$N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping, and $N_{RxBeam,i}$=1 if PRS layer i is in FR1 and $N_{RxBeam,i}$=8 if PRS layer i is in FR2,

$L_{PRS,i}$ is the time duration specified in clause 5.1.6.5 of TS 38.214 [26, clause 5.1.6.5],

$\mathrm{N_{PRS,i}^{slot}}$ is the maximum number of DL PRS resources of frequency layer i configured in a slot, {N, T} is UE capability combination per band where N is a duration of DL PRS symbols in ms corresponding to *durationOfPRS-ProcessingSysmbols* in TS 37.355 [34] processed every T ms corresponding to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34] for a given maximum bandwidth supported by UE corresponding to *supportedBandwidthPRS* in TS 37.355 [34],

N' is UE capability for number of DL PRS resources that it can process in a slot as indicated by *maxNumOfDL-PRS-ResProcessedPerSlot* in clause 6.4.3 of TS 37.355 [34],

N_{sample} is the number of PRS-RSRP measurement samples and N_{sample}= 4,

T_{last} is the measurement duration for the last PRS-RSRP sample, including the sampling time and processing time, $T_{last} = T_i + L_{PRS,i}$ $\mathrm{T_{effect,i}}$ is periodicity of PRS-RSRP measurement in frequency layer i:

$$\mathrm{T_{effect,i}} = \left\lceil \frac{T_i}{T_{available\_PRS,i}} \right\rceil * T_{available\_PRS,i}$$

where

$\mathrm{T_i}$ corresponds to *durationOfPRS-ProcessingSymbolsInEveryTms* in TS 37.355 [34],

$T_{available\_PRS,\mathrm{i}} = LCM(T_{PRS,\mathrm{i}}, MGRP_{\mathrm{i}})$, the least common multiple between $T_{PRS,i}$ and $MGRP_i$

$\mathrm{T_{PRS,i}}$ is the maximum PRS resource periodicity among all PRS resources in frequency layer i,

$MGRP_{\mathrm{i}}$ is the measurement gap repetition period in frequency layer i.

When PRS-RSRP measurements are configured for DL-AoD, the time $T_{PRS-RSRP,i}$ starts from the first MG instance aligned with DL PRS resources of positioning frequency layer *i* closest in time after both the *NR-DL-AoD-RequestLocationInformation* message and *NR-DL-AoD-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

If handover occurs while PRS-RSRP measurements are being performed then the UE shall complete the ongoing PRS-RSRP measurements session. The UE shall also meet the PRS-RSRP measurement requirements in this clause and measurement accuracy requirements in clause 10.1.24. However in this case the PRS-RSRP measurement period $\mathrm{T_{PRS-RSRP,total.HO}}$ shall be as follows:

$$\mathrm{T_{PRS-RSRP,total,HO}} = \mathrm{T_{PRS-RSRP,total}} + K * \mathrm{T_{effect}} + \mathrm{T_{HO}} \quad ms$$

where

K is the number of times handover occurs during $\mathrm{T_{PRS-RSRP,total.HO}}$;

$\mathrm{T_{effect}}$ is the largest $\mathrm{T_{effect,i}}$ among all PRS layers;

$\mathrm{T_{HO}}$ is the time during which the PRS-RSRP measurement may not be possible due to handover; it can be up to $\mathrm{T_{interrupt}}$ as defined in clause 6.1.

When the PRS-RSRP measurement is configured together with UE Rx-Tx time difference measurement, the UE behaviour at a serving cell change for the PRS-RSRP measurement is the same as the UE behaviour for the UE Rx-Tx time difference measurement specified in clause 9.9.4.5, and the PRS-RSRP measurement shall meet the accuracy requirements in clause 10.1.24.

When the PRS-RSRP measurement is configured together with RSTD measurement, the UE behaviour at a serving cell change for the PRS-RSRP measurement is the same as the UE behaviour for the RSTD measurement specified in clause 9.9.2.5, and the PRS-RSRP measurement shall meet the accuracy requirements in clause 10.1.24.

9.9.4 UE Rx-Tx time difference measurements

9.9.4.1 Introduction

The requirements in this clause shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to measure one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

9.9.4.2 Requirements Applicability

The requirements in clause 9.9.4 apply, provided:

- UE Rx-Tx time difference measurement related side conditions given in clause 10.1.25 are met for a corresponding band.

9.9.4.3 Measurement Capability

UE Rx-Tx time difference measurement capability is as reported by the UE according to TS 37.355 [34].

9.9.4.4 Measurement Reporting Requirements

This requirement assumes that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTIDCCH where TTIDCCH is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported UE Rx-Tx time difference measurement values reported shall be based on the measurement report mapping requirements specified in clause 10.1.25.

Editor's note: the measurement reporting requirements for aperiodic reports are FFS.

The UE Rx-Tx time difference measurement accuracy for all measured DL PRS resources shall be fulfilled according to the accuracy requirements specified in clause 10.1.25.

9.9.4.5 Measurement Period Requirements

When physical layer receives last of *NR-Multi-RTT-ProvideAssistanceData* message and *NR-Multi-RTT-RequestLocationInformation* message from LMF via LPP [34], UE shall be able to measure multiple (up to the UE capability specified in clause 9.9.4.3) UE Rx-Tx time difference measurements as defined in TS 38.215 [4] in configured positioning frequency layers within the measurement period $\mathrm{T_{UERxTx,Total}}$ ms.

If measurement gaps and processing time T have overlap between different frequency positioning frequency layers,

$$\mathrm{T_{UERxTx,\ Total}} = \sum_{i=1}^{L} \mathrm{T_{UERxTx,i}} + (L-1) * \max\left(\mathrm{T}_{\mathrm{effect},i}\right).$$

Editor's Note: FFS the UE Rx-Tx time difference measurement period when measurement gaps and processing time T do not have overlap between different positioning frequency layers.

where i is the index of PRS frequency layer,

$\mathrm{T_{UERxTx,i}}$ is the measurement period for PRS frequency layer i as further defined in this clause,

L is total number of positioning frequency layers, and

$\mathrm{T}_{\mathrm{effect},i}$ is the periodicity of the UE Rx-Tx time difference measurement in PRS frequency layer i

$$\mathrm{T_{UERxTx,i}} = \left(\mathrm{CSSF_i} * N_{RxBeam,i} * \left\lceil \frac{N_{PRS,\mathrm{i}}^{slot}}{N'} \right\rceil \left\lceil \frac{L_{PRS,\mathrm{i}}}{N} \right\rceil * N_{sample} - 1\right) * \mathrm{T_{effect,i}} + \mathrm{T_{last}}$$

Where

$\mathrm{CSSF_i}$ is scaling factor for NR positioning measurements as defined in clause 9.1.5.2,

$N_{RxBeam,i}$ is the scaling factor for Rx beam sweeping, and $N_{RxBeam,i}$=1 if PRS layer i is in FR1 and $N_{RxBeam,i}$=8 if PRS layer i is in FR2,

$L_{PRS,i}$ is the time duration specified in clause 5.1.6.5 of TS 38.214 [26, clause 5.1.6.5]

$N_{PRS,i}^{slot}$ is the maximum number of DL PRS resources of frequency layer i configured in a slot,

$\{N, T\}$ is UE capability combination per band where N is a duration of DL PRS symbols in ms processed every T ms for a given maximum bandwidth supported by UE as specified in clause 4.2.7.2 of TS 38.306 [14],

N' is UE capability for number of DL PRS resources that it can process in a slot as specified in clause 4.2.7.2 of TS 38.306 [14],

N_{sample} is the number of UE Rx-Tx time difference measurement samples and N_{sample}= [4],

$T_{effect,i}$ is periodicity of UE Rx-Tx time difference measurement in frequency layer i:

$$T_{effect,i} = \left\lceil \frac{T_i}{T_{available\_PRS,i}} \right\rceil * T_{available\_PRS,i}$$

where $T_{available\_PRS,i} = LCM(T_{PRS,i}, MGRP_i)$, the least common multiple between $T_{PRS,i}$ and $MGRP_i$

$T_{PRS,i}$ is the maximum PRS resource periodicity among all PRS resources in frequency layer i,

$MGRP_i$ is the repetition periodicity of the measurement gap applicable for measurement in frequency layer i.

If the frequency layer *i* has more than one DL PRS resource sets with different PRS periodicities, the maximum PRS periodicity among DL PRS resource sets is used to derive the measurement period of that positioning frequency layer.

The time $T_{UERxTx,i}$ starts from the first MG instance aligned with DL PRS resources of positioning frequency layer *i* closest in time after both the *NR-Multi-RTT-RequestLocationInformation* message and *NR-Multi-RTT-ProvideAssistanceData* message from LMF via LPP [34] are delivered to the physical layer of UE.

The UE Rx-Tx time difference measurement period is restarted if HO occurs during the measurement period and after SRS reconfiguration on the target cell is complete.

*Editors Note: The applicability of requirements if the time duration of a DL PRS resource exceeds the UE capability N.*9.9.5 NR E-CID measurements

9.9.5.1 Introduction

The requirements in clause 9.9.5 shall apply provided the UE has received *nr-ECID-RequestLocationInformation* message from LMF via LPP [34] requesting the UE to report one or more of the following measurements for NR E-CID positioning [22]: SS-RSRP, SS-RSRQ, CSI-RSRP, and CSI-RSRQ.

9.9.5.2 Measurement Requirements

9.9.5.2.1 Intra-frequency Measurement Requirements

The intra-frequency NR E-CID measurements shall meet the requirements in clause 9.2, except the measurement reporting requirements. The NR E-CID measurement reporting requirements are defined in clause 9.9.5.2.3.

The reported intra-frequency NR E-CID measurements shall also meet:

- for FR1 SS-RSRP, the accuracy requirements in clauses 10.1.2,
- for FR1 SS-RSRQ, the accuracy requirements in clauses 10.1.7,
- for FR1 CSI-RSRP, the accuracy requirements in clause 10.1,
- for FR1 CSI-RSRQ, the accuracy requirements in clause 10.1,
- for FR2 SS-RSRP, the accuracy requirements in clauses 10.1.3,
- for FR2 SS-RSRQ, the accuracy requirements in clauses 10.1.8,
- for FR2 CSI-RSRP, the accuracy requirements in clause 10.1,

- for FR2 CSI-RSRQ, the accuracy requirements in clause 10.1.

9.9.5.2.2 Inter-frequency Measurement Requirements

The inter-frequency NR E-CID measurements shall meet the requirements in clause 9.3, except the measurement reporting requirements. The NR E-CID measurement reporting requirements are defined in clause 9.9.5.2.3.

The reported inter-frequency NR E-CID measurements shall also meet:

- for FR1 SS-RSRP, the accuracy requirements in clauses 10.1.4,
- for FR1 SS-RSRQ, the accuracy requirements in clauses 10.1.9,
- for FR1 CSI-RSRP, the accuracy requirements 10.1,
- for FR1 CSI-RSRQ, the accuracy requirements 10.1,
- for FR2 SS-RSRP, the accuracy requirements in clauses 10.1.5,
- for FR2 SS-RSRQ, the accuracy requirements in clauses 10.1.10,
- for FR2 CSI-RSRP, the accuracy requirements 10.1,
- for FR2 CSI-RSRQ, the accuracy requirements 10.1.

9.9.5.2.3 Measurement Reporting Delay

The measurement reporting delay is defined as the time between the moment when the periodic measurement report is triggered and the moment when the UE starts to transmit the measurement report over the air interface. This requirement assumes that that the measurement report is not delayed by other LPP signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH} where TTI_{DCCH} is the duration of subframe or slot or subslot when the measurement report is transmitted on the PUSCH with subframe or slot or subslot duration. This measurement reporting delay excludes any delay caused by no UL resources for UE to send the measurement report.

The reported NR E-CID measurement values contained in periodically triggered measurement reports shall be based on the measurement report mapping requirements specified in clauses 10.1.6 and 10.1.11 for SS-RSRP and SS-RSRQ, respectively, and clause 10.1 for CSI-RSRP and CSI-RSRQ, respectively.

The UE shall not send any measurement reports as long as no corresponding reporting criteria specified in clause 9.1.4 are fulfilled.

9.10 CSI-RS based L3 measurements

9.10.1 Introduction

This clause contains general requirements on the UE regarding CSI-RS based measurement reporting in RRC_CONNECTED state. The requirements are split in intra-frequency and inter-frequency measurements requirements.

The requirements in this clause apply, provided:

- Only one MO is configured on the CSI-RS layer, and
- all CSI-RS resources in the same MO are configured with the same csi-rs-MeasurementBW, and
- associated SSB is QCLed with the corresponding CSI-RS resources in FR2, and
- the CSI-RS resources on one frequency layer are configured within a window of up to 5ms where the measurements of CSI-RS on the frequency layer are to be performed, and
- the number of CSI-RS resources in any duration that equal to the length of a slot is no larger than UE capability *maxNumberCSI-RS-RRM-RS-SINR*.

9.10.2 CSI-RS based intra-frequency measurements

9.10.2.1 Introduction

A measurement is defined as a CSI-RS based intra-frequency measurement provided that:

- the SCS of the CSI-RS resource of the neighbour cell configured for measurement is the same as the SCS of the CSI-RS resource on the serving cell indicated for measurement, and
- the CP type of the CSI-RS resource of neighbour cell configured for measurement is the same as the CP type of the CSI-RS resource of the serving cell indicated for measurement, and
  - It is applied for SCS = 60KHzs
- the centre frequency of the CSI-RS resource of the neighbour cell configured for measurement is the same as the centre frequency of the CSI-RS resource of the serving cell indicated for measurement

The UE shall be able to identify new intra-frequency cells and perform CSI-RSRP, CSI-RSRQ and CSI-SINR measurements of identified intra-frequency cells if carrier frequency information is provided by PCell or the PSCell.

Intra-frequency CSI-RS resources are completely contained within the active BWP bandwidth.

No measurement gap is needed for intra-frequency CSI-RS resources measurements.

For intra-frequency CSI-RS based measurements, UE may cause scheduling restriction as specified in clause 9.10.2.5.

Note: Extended CP for CSI-RS based measurement is not supported in this release.

9.10.2.2 Requirements applicability

The associated SSB layer of the CSI-RS follows the same requirements as SSB based measurements defined in 9.2

The requirements in clause 9.10.2 apply, provided:

- Only one intra-frequency CSI-RS layer per serving cell is configured, and
- The BW of the CSI-RS on the intra-frequency neighbor cell is within the active BWP of the UE, and
- The CSI-RS resources and the associated SSB of the cell being identified or measured are detectable, and
- The bandwidth of CSI-RS resources of intra-MO is the same as that of the CSI-RS resources configured for the serving cell, and
- Numerology for intra-frequency CSI-RS and data of serving cell are the same.

An intra-frequency cell shall be considered detectable when for each relevant CSI-RS and associated SSB:

- CSI-RSRP related side conditions given in clauses 10.1.x and 10.1.x for FR1 and FR2, respectively, for a corresponding Band,
- CSI-RSRQ related side conditions given in clauses 10.1.x and 10.1.x for FR1 and FR2, respectively, for a corresponding Band,
- CSI-SINR related side conditions given in clauses 10.1.x and 10.1.x for FR1 and FR2, respectively, for a corresponding Band,
- CSI_RP and CSI-RS Ês/Iot according to Annex B.2.x for a corresponding Band.
- SS-RSRP related side conditions given in clauses 10.1.2 and 10.1.3 for FR1 and FR2, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in clauses 10.1.7 and 10.1.8 for FR1 and FR2, respectively, for a corresponding Band,
- SS-SINR related side conditions given in clauses 10.1.12 and 10.1.13 for FR1 and FR2, respectively, for a corresponding Band,

- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding Band.

9.10.2.3 Number of cells and number of CSI-RS

9.10.2.3.1 Requirements for FR1

For each intra-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 32 CSI-RSs with different CSI-RS index and/or PCI on the intra-frequency layer, and
- the cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB

9.10.2.3.2 Requirements for FR2

For one single intra-frequency CSI-RS layer in a band, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 32 CSI-RSs with different CSI-RS index and/or PCI, and
- the cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB.

where this single intra-frequency layer shall be:

- PCC on which UE is configured to report CSI-RS measurement when UE is configured with SA NR operation mode with PCC in the band; or
- PSCC on which UE is configured to report CSI-RS measurement when UE is configured with EN-DC with PSCC in the band; or
- One of the SCCs on which UE is configured to report CSI-RS based measurements when neither PCC nor PSCC is in the same band, so that the selected SCC shall be an SCC where the UE is configured with CSI-RSRP measurement reporting if such SCC exists, otherwise the selected SCC is determined by UE implementation.

The UE shall also be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least 2 CSI-RSs on serving cell for each of the other intra-frequency layer(s) in the same band.

For each FR2 band, UE is only required to measure neighbour cell CSI-RS on the CSI-RS layer, whose associated SSB should be on the same SSB layer as the one where UE is required to measure neighbour cell SSB.

9.10.2.4 Measurement Reporting Requirements

9.10.2.4.1 Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodic measurement reports shall meet the requirements in clauses 10.1.

9.10.2.4.2 Event-triggered Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in event-triggered periodic measurement reports shall meet the requirements in clauses 10.1.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.9.2.4.3.

9.10.2.4.3 Event Triggered Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI- SINR measurements contained in event triggered measurement reports shall meet the requirements in clauses 10.1.

The UE shall not send any event triggered measurement reports as long as no reporting criteria is fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: 2 x TTI_{DCCH}. This measurement reporting delay excludes a delay which caused by no UL resources being available for UE to send the measurement report on.

The event triggered measurement reporting delay, measured without L3 filtering shall be less than the CSI-RS based measurement defined in clause 9.10.2.5. When L3 filtering is used an additional delay can be expected.

9.10.2.5 Intra-frequency measurements without measurement gaps

If a UE is configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB*, the CSI-RS based measurement shall include PSS/SSS detection time of associatedSSB, the time period used to acquire the SFN information and CSI-RS based measurement period without gap.

PSS/SSS detection time of associatedSSB is the intra-frequency T_{PSS/SSS_sync_intra} in Clause 9.2.5.1. If the associatedSSB is already detected, the time period is equal to 0.

The time period used to acquire the SFN information is intra-frequency $T_{SSB\_time\_index\_intra}$ in Clause 9.2.5.1 or in clause 9.2.6.2 or inter-frequency $T_{SSB\_time\_index\_inter}$ in clause 9.3.4. If the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled), the time period is equal to 0. It is assumed that deriveSSB-IndexFromCell is always enabled for FR1 TDD and FR2.

The measurement period for intrafrequency measurements without gaps is as shown in table 9.10.2.5-1, Table 9.10.2.5-2.

Additionally, for a given CSI-RS resource, if the associated SS/PBCH block is configured but not detected by the UE, or if CSI-RS configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10.2.5-1: Measurement period for intrafrequency CSI-RS based measurements without gaps(Frequency FR1)

DRX cycle	$T_{CSI\text{-}RS\_measurement\_period\_intra}$
No DRX	max(200ms, ceil([5] x K_p) x CSI-RS period) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(200ms, ceil(1.5x [5] x K_p) x max(CSI-RS period, DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	ceil([5] x K_p) x DRX cycle x $CSSF_{intra}$
NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS38.211 [6].	

Table 9.10.2.5-2: Measurement period for intrafrequency CSI-RS based measurements without gaps(Frequency FR2)

DRX cycle	$T_{CSI\text{-}RS\_measurement\_period\_intra}$
No DRX	max(400ms, ceil($M_{meas\_period\_w/o\_gaps}$ x K_p) x CSI-RS period) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(400ms, ceil(1.5x $M_{meas\_period\_w/o\_gaps}$ x K_p) x max(CSI-RS period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	$M_{meas\_period\_w/o\_gaps}$ x DRX cycle x $CSSF_{intra}$
NOTE 1: The requirements apply assuming CSI-RS configuration with {D=3 with PRBs ≥ 48}. D is frequency domain density for the 1-port CSI-RS for L3 mobility defined in clause 7.4.1 of TS38.211 [6].	

$M_{meas\_period\_w/o\_gaps}$: For a UE supporting power class 1, $M_{meas\_period\_w/o\_gaps}$ =[40]. For a UE supporting FR2 power class 2, $M_{meas\_period\_w/o\_gaps}$ =[24]. For a UE supporting power class 3, $M_{meas\_period\_w/o\_gaps}$ =[24]. For a UE supporting power class 4, $M_{meas\_period\_w/o\_gaps}$ =[24].

$CSSF_{intra}$: it is a carrier specific scaling factor and is determined according to $CSSF_{outside\_gap,i}$ in clause 9.1.5.

If any CSI-RS resource in the CSI-RS MO is fully overlapping with gap, then the CSI-RS MO shall be measured within gap, otherwise,

- if intra-frequency CSI-RS resource is fully non overlapping with measurement gaps, Kp=1;

- if intra-frequency CSI-RS resource is partially overlapping with measurement gaps, Kp = 1/(1- (CSI-RS resource period /MGRP)).

9.10.2.6 Scheduling availability of UE during CSI-RS based intra-frequency measurements

UE is required to be capable of measuring without measurement gaps when CSI-RS resources are completely contained in the active BWP of the UE. Note the configured CSI-RS symbol is indicated in *firstOFDMSymbolInTimeDomain* included in *CSI-RS-ResourceConfigMobility* for RRM. When UE is required to perform CSI-RS based RRM measurements, and any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note same numerology for intra-frequency CSI-RS and data of serving cell is considered in this release.

9.10.2.6.1 Scheduling availability of UE performing CSI-RS based measurements in TDD bands

Editor's note: scheduling restriction in TDD band may be added after RAN4 reaches the consensus on the requirement.

9.10.2.6.2 Scheduling availability of UE performing CSI-RS based measurements in FR2

When the UE performs CSI-RS based intra-frequency measurements for L3 mobility management in FR2, the following restrictions apply.

- The UE is not expected to receive PDCCH/PDSCH/TRS on the configured CSI-RS symbol within the configured slot as indicated in *slotConfig* of the corresponding CSI-RS resource to be measured for mobility.

9.10.3 CSI-RS based Inter-frequency measurements

9.10.3.1 Introduction

A measurement is defined as a CSI-RS based inter-frequency measurement provided it is not defined as an intra-frequency measurement according to clause 9.10.2.

If a UE is configured with the higher layer parameter *CSI-RS-Resource-Mobility* and the higher layer parameter *associatedSSB* is configured, the UE shall be able to identify inter-frequency cells indicated for measurment and perform CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements of identified inter-frequency cells.

When measurement gaps are needed, the UE is not expected to detect the associated SSB nor perform measurement of the CSI-RS resource configured in *CSI-RS-Resource-Mobility* on an inter-frequency measurement object which start earlier than the gap starting time + switching time, and ends later than the gap end – switching time. When the inter-frequency cells are in FR2 and the per-FR gap is configured to the UE in EN-DC, SA NR, NE-DC and NR-DC, or the serving cells are in FR2, the inter-frequency cells are in FR2 and the per-UE gap is configured to the UE in SA NR and NR-DC, the switching time is 0.25ms. Otherwise the switching time is 0.5ms.

9.10.3.2 Requirements applicability

The associated SSB layer of the CSI-RS follows the same requirements as SSB based measurements defined in 9.3.

The requirements in clause 9.10.3 apply, provided:

- The associated SSB of the cell being identified or measured is detectable, and

- CSI-RS resources for measurements and the associated SSB for cell identification are configured within measurement gap.

An inter-frequency cell shall be considered detectable when for each relevant CSI-RS and associated SSB:

- SS-RSRP related side conditions given in clauses 10.1.4 and 10.1.5 for FR1 and FR2, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in clauses 10.1.9 and 10.1.10 for FR1 and FR2, respectively, for a corresponding Band,
- SS-SINR related side conditions given in clauses 10.1.14 and 10.1.15 for FR1 and FR2, respectively, for a corresponding Band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.3 for a corresponding Band.
- CSI-RSRP related side conditions given in clauses 10.1.x and 10.1.x for FR1 and FR2, respectively, for a corresponding Band,
- CSI-RSRQ related side conditions given in clauses 10.1.x and 10.1.x for FR1 and FR2, respectively, for a corresponding Band,
- CSI-SINR related side conditions given in clauses 10.1.x and 10.1.x for FR1 and FR2, respectively, for a corresponding Band,
- CSI _RP and CSI-RS Ês/Iot according to Annex B.2.x for a corresponding Band.

9.10.3.3 Number of cells and number of CSI-RS resources

9.10.3.3.1 Requirements for FR1

For each inter-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 14 CSI-RSs with different CSI-RS index and/or PCI , and
- The cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer of the associated SSB.

9.10.3.3.2 Requirements for FR2

For each inter-frequency CSI-RS layer, during each layer 1 measurement period, the UE shall be capable of performing CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements for at least:

- 24 CSI-RSs with different CSI-RS index and/or PCI, and
- The cells to be monitored based on CSI-RS are the same set or a subset of the cells monitored based on the layer the associated SSB.

9.10.3.4 Measurements reporting requirements

9.10.3.4.1 Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.

9.10.3.4.2 Event-triggered Periodic Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.

The first report in event triggered periodic measurement reporting shall meet the requirements specified in clause 9.10.3.4.3.

9.10.3.4.3 Event-triggered Reporting

Reported CSI-RSRP, CSI-RSRQ, and CSI-SINR measurements contained in periodically triggered measurement reports shall meet the requirements in clauses 10.1.

The UE shall not send any event triggered measurement reports, as long as no reporting criteria are fulfilled.

The measurement reporting delay is defined as the time between an event that will trigger a measurement report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty resulted when inserting the measurement report to the TTI of the uplink DCCH. The delay uncertainty is: $2 \times TTI_{DCCH}$. This measurement reporting delay excludes a delay which caused by no UL resources for UE to send the measurement report.

The event triggered measurement reporting delay, measured without L3 filtering shall be within CSI-RS based measurement defined in clause 9.11.3.5. When L3 filtering is used an additional delay can be expected.

9.10.3.5 Inter frequency measurements with measurement gaps

When measurement gaps are provided, if configured with the higher layer parameters *CSI-RS-Resource-Mobility* and *associatedSSB*, the UE shall be able to identify a new detectable CSI-RS based inter frequency cell within $T_{CSI-RS\_identify\_inter}$,

$$T_{CSI-RS\_identify\_inter} = (T_{PSS/SSS\_sync} + T_{CSI-RS\_measurement\_period\_inter} + T_{SSB\_time\_index})\ ms$$

Where:

T_{PSS/SSS_sync} is the time period used in PSS/SSS detection and $T_{SSB\_time\_index}$ is the time period used to acquire the index of the SSB being measured, which are determined according to T_{PSS/SSS_sync_inter} and $T_{SSB\_time\_index\_inter}$ given in clause 9.3.4 for SSB based inter-frequency measurement,

$T_{CSI-RS\_measurement\_period\_inter}$: equal to a measurement period of CSI-RS based measurement given in table 9.10.3.5-1 and table 9.10.3.5-2..

$M_{meas\_period\_inter}$: For a UE supporting FR2 power class 1, $M_{meas\_period\_inter}$ =8×N samples. For a UE supporting FR2 power class 2, $M_{meas\_period\_inter}$=5×N samples. For a UE supporting FR2 power class 3, $M_{meas\_period\_inter}$ =5×N samples. For a UE supporting FR2 power class 4, $M_{meas\_period\_inter}$ = 5×N samples. Note that scaling factor N = [8].$CSSF_{inter}$: it is a carrier specific scaling factor and is determined according to $CSSF_{within\_gap,i}$ in clause 9.1.5 for measurement conducted within measurement gaps.

Additionally, for a given CSI-RS resource, if the associated SSB is configured but not detected by the UE, or if CSI-RS configured with associated SSB but not QCL-ed to the associated SSB, the UE is not required to monitor the corresponding CSI-RS resource.

Table 9.10.3.5-1: Measurement period for CSI-RS based inter-frequency measurements with gaps (Frequency FR1)

Condition NOTE1,2	$T_{CSI-RS\_measurement\_period\_inter}$
No DRX	Max(200ms, 8 × Max(MGRP, CSI-RS period)) × $CSSF_{inter}$
DRX cycle ≤ 320ms	Max(200ms, Ceil(8 × 1.5) × Max(MGRP, CSI-RS period, DRX cycle)) × $CSSF_{inter}$
DRX cycle > 320ms	8 × DRX cycle × $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

Table 9.10.3.5-2: Measurement period for CSI-RS based inter-frequency measurements with gaps (Frequency FR2)

Condition NOTE1,2	$T_{CSI\text{-}RS\_measurement\_period\_inter}$
No DRX	Max(400 ms, $M_{meas\_period\_inter} \times$ Max(MGRP, CSI-RS period)) $\times$ $CSSF_{inter}$
DRX cycle ≤ 320ms	Max(400 ms, (1.5 $\times$ $M_{meas\_period\_inter}$) $\times$ Max(MGRP, CSI-RS period, DRX cycle)) $\times$ $CSSF_{inter}$
DRX cycle > 320ms	$M_{meas\_period\_inter} \times$ DRX cycle $\times$ $CSSF_{inter}$
NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1 NOTE 2: In EN-DC operation, the parameters, timers and scheduling requests referred to in clause 3.6.1 are for the secondary cell group. The DRX cycle is the DRX cycle of the secondary cell group.	

9.11 NR measurements with autonomous gaps

9.11.1 Introduction

The requirements in this clause are applicable for CGI identification of an intra frequency and inter frequency NR target cell.

The requirements in this clause are specified for CGI identification of an NR target cell and are applicable for a UE:

- in RRC_CONNECTED state, and
- configured with SA or NR-DC or NE-DC operation mode, or with EN-DC operation mode for CGI identification requested by NR PSCell.

The overall CGI reporting delay is defined in clause 9.11.3.

9.11.2 CGI identification of an NR cell with autonomous gaps

The UE shall identify and report the CGI of a known NR target cell when requested by the network for the purpose of reportCGI. Only one cell is provided to the UE with *cellForWhichToReportCGI* for identifying the CGI.The UE may make autonomous gaps in both downlink reception and uplink transmission for receiving MIB and SIB1 message according to clause 5.5.3 of TS 38.331 [2]. Note that a UE is not required to use autonomous gap if *useAutonomousGaps* is set to false. If autonomous gaps are used for measurement with the purpose of reportCGI, regardless of whether DRX is used or not, or whether SCell(s) are configured or not, the UE shall be able to identify a new CGI of NR cell within:

$$T_{identify\_CGI} = (T_{MIB} + T_{SIB1}) \text{ ms}$$

Where:

T_{MIB} is the time period used to acquire MIB message. $T_{MIB} = 6 * T_{SMTC}$ ms for target cell carrier frequency on FR1 and $T_{MIB} = 25 * T_{SMTC}$ ms for target cell carrier frequency on FR2.

T_{SIB1} is the time period used to acquire SIB1 message. $T_{SIB1} = 6 * T_{RMSI\text{-}scheduling}$ ms.

Where $T_{RMSI\text{-}scheduling}$ is the periodicity with which the SIB1 is actually transmitted by the NR target cell.

The requirement for identifying the CGI of an NR cell within $T_{identify\_CGI}$ is applicable when no DRX is used as well as when any of the DRX cycles specified in TS 38.331 [2] is used.

Within the time $T_{identify\_CGI}$, over which the UE identifies the CGI of an NR cell, the UE shall fulfil interruption requirements specified in,

- Clause 8.2.1.2.16 for NR serving cells and Clause 7.32.2.15 in TS36.133 [15] for E-UTRA serving cells if the UE is configured with EN-DC operation mode,
- Clause 8.2.2.2.14 if the UE is configured with SA operation mode,
- Clause 8.2.3.2.14 for NR serving cells and Clause 7.36.2.14 in TS36.133 [15] for E-UTRA serving cells if the UE is configured with NE-DC operation mode,

- Clause 8.2.4.2.11 if the UE is configured with NR-DC operation mode.

In the requirement a cell is known if,

- During the last 5 seconds for FR1 or 3 seconds for FR2 before the reception of the report CGI command:
  - The UE has sent a valid L3-RSRP measurement report with SSB index for the target cell and
- During MIB decoding at least reported SSBs remains detectable according to the cell identification conditions specified in clauses 9.2 or 9.3 of TS 38.133, and
- During SIB1 decoding the SSB used for MIB decoding remains detectable according to the cell identification conditions specified in clauses 9.2 or 9.3 of TS 38.133, and
- During MIB decoding, the SSB for MIB decoding remains detectable with SNR ⩾-3dB
- During SIB1 decoding, the PDSCH for SIB1 decoding remains detectable with SNR ⩾-3dB

9.11.3 CGI reporting delay

The CGI reporting delay is defined as the time between a command that will trigger a CGI report and the point when the UE starts to transmit the measurement report over the air interface. This requirement assumes that the measurement report is not delayed by other RRC signalling on the DCCH. This measurement reporting delay excludes a delay uncertainty of 2 x TTI_{DCCH} resulting when inserting the measurement report to the TTI of the uplink DCCH. This measurement reporting delay excludes any delay caused by lack of UL resources for UE to send the measurement report.

The CGI reporting delay shall be less than $T_{identify\_CGI}$ defined in clause 9.11.2 plus RRC procedure delay defined in clause 12 in TS 38.331 [2], and additional 20ms margin if target cell is on FR2.

10 Measurement Performance requirements

10.1 NR measurements

10.1.1 Introduction

The requirements in clause 10.1 apply as follows:

- intra-frequency requirements apply for PCell measurements in SA, NR-DC, or NE-DC operaion mode,
- intra-frequency requirements apply for PSCell measurements in NR-DC or EN-DC operaion mode,
- intra-frequency requirements apply for SCell measurements in SA operation mode with NR CA or any MR-DC operaion mode with NR CA,
- inter-frequency requirements apply for non-serving cell measurements on NR carrier frequencies.
- inter-frequency requirements apply for measurements from one cell on a frequency compared to the measurement from another cell on a different frequency.

In the requirements of clause 10.1, the exceptions for side conditions apply as follows:

- for the UE capable of CA but not configured with any SCell, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.1 for UE supporting CA in FR1, and clause B.3.2.3 for UE supporting CA in FR2, respectively;
- for the UE capable of CA and configured with at least one SCell, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.2 for UE configured with CA in FR1, and clause B.3.2.4 for UE supporting CA in FR2 respectively;

- for the UE capable of SUL but not configured with SUL, the applicable exceptions for side conditions are specified in Annex B, clause B.3.4.1 for UE supporting SUL in FR1;
- for the UE capable of SUL and configured with at least one SUL, the applicable exceptions for side conditions are specified in Annex B, clause B.3.4.2 for UE configured with SUL in FR1.

10.1.2 Intra-frequency RSRP accuracy requirements for FR1

10.1.2.1 Intra-frequency SS-RSRP accuracy requirements

10.1.2.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on the same frequency as that of the serving cell in FR1. The accuracy requirements in this clause are also applicable when *highSpeedMeasFlag-r16* is configured.

The accuracy requirements in Table 10.1.2.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.

Table 10.1.2.1.1-1: SS-RSRP Intra frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range				
			NR operating band groups Note 2	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±9	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
±8	±11	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_FDD_FR1_H	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.2.1.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS-RSRP levels measured on the same cell in FR1. The accuracy requirements in this clause are also applicable when *highSpeedMeasFlag-r16* is configured.

The accuracy requirements in Table 10.1.2.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.

Table 10.1.2.1.2-1: SS-RSRP Intra frequency relative accuracy in FR1

Accuracy		**Conditions**					
Normal condition	**Extreme condition**	**SSB Ês/Iot** Note 2	**Io** Note 1 **range**				
			NR operating band groups Note 4	**Minimum Io**			**Maximum Io**
dB	**dB**	**dB**		**dBm / SCS_{SSB}**		**dBm/$BW_{Channel}$**	**dBm/$BW_{Channel}$**
				SCS_{SSB} = 15 kHz	**SCS_{SSB} = 30 kHz**		
±2	±3	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
±3	±3	≥-6	Note 3	Note 3	Note 3	N/A	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.2.2 Void

10.1.3 Intra-frequency RSRP accuracy requirements for FR2

10.1.3.1 Intra-frequency SS-RSRP accuracy requirements

10.1.3.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 10.1.3.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.3.1.1-1: SS-RSRP Intra frequency absolute accuracy in FR2

<table>
<tr><th colspan="2">Accuracy</th><th colspan="5">Conditions</th></tr>
<tr><th rowspan="2">Normal condition</th><th rowspan="2">Extreme condition</th><th rowspan="2">SSB Ês/Iot</th><th colspan="4">Io Note 2 range</th></tr>
<tr><th colspan="3">Minimum Io</th><th>Maximum Io</th></tr>
<tr><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2">dB</th><th colspan="2">dBm / SCS_{SSB} Note 1</th><th rowspan="2">dBm/BW_{Channel}</th><th rowspan="2">dBm/BW_{Channel}</th></tr>
<tr><th>SCS_{SSB} = 120kHz</th><th>SCS_{SSB} = 240kHz</th></tr>
<tr><td>±6</td><td>±9</td><td rowspan="2">≥-6</td><td colspan="2">Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival</td><td>N/A</td><td>-70</td></tr>
<tr><td>±8</td><td>±11</td><td colspan="2">N/A</td><td>-70</td><td>-50</td></tr>
<tr><td colspan="7">Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.</td></tr>
</table>

10.1.3.1.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell compared to the SS-RSRP measured from another cell on the same frequency, or between any two SS-RSRP levels measured on the same cell in FR2.

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.3.1.2-1: SS-RSRP Intra frequency relative accuracy in FR2

<table>
<tr><th colspan="2">Accuracy</th><th colspan="4">Conditions</th></tr>
<tr><th rowspan="2">Normal condition</th><th rowspan="2">Extreme condition</th><th rowspan="2">SSB Ês/Iot</th><th colspan="3">Io Note 2 range</th></tr>
<tr><th colspan="2">Minimum Io</th><th>Maximum Io</th></tr>
<tr><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2">dB</th><th colspan="2">dBm / SCS_{SSB} Note 1</th><th rowspan="2">dBm/BW_{Channel}</th></tr>
<tr><th>SCS_{SSB} = 120kHz</th><th>SCS_{SSB} = 240kHz</th></tr>
<tr><td>±6</td><td>±9</td><td>≥-6</td><td colspan="2">Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival</td><td>-50</td></tr>
<tr><td colspan="6">Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
Note 4: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.</td></tr>
</table>

10.1.3.2 Void

10.1.4 Inter-frequency RSRP accuracy requirements for FR1

10.1.4.1 Inter-frequency SS-RSRP accuracy requirements

10.1.4.1.1 Absolute Accuracy of SS-RSRP in FR1

The requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.4.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.

Table 10.1.4.1.1-1: SS-RSRP Inter frequency Absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±4.5	±9	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
±8	±11	≥-6	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_FDD_FR1_H	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: Void NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.4.1.2 Relative Accuracy of SS-RSRP in FR1

The relative accuracy of SS-RSRP in inter frequency case is defined as the RSRP measured from one cell on a frequency in FR1compared to the RSRP measured from another cell on a different frequency in FR1.

The accuracy requirements in Table 10.1.4.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $|SSB\_RP1_{dBm} - SSB\_RP2_{dBm}| \leqslant 27$ dB
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1.4.1.2-1: SS-RSRP Inter frequency relative accuracy in FR1

<table>
<tr><th colspan="2">Accuracy</th><th colspan="6">Conditions</th></tr>
<tr><th rowspan="2">Normal condition</th><th rowspan="2">Extreme condition</th><th rowspan="2">SSB Ês/Iot Note 2</th><th colspan="5">Io Note 1 range</th></tr>
<tr><th>NR operating band groups Note 3</th><th colspan="3">Minimum Io</th><th>Maximum Io</th></tr>
<tr><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2"></th><th colspan="2">dBm / SCS_{SSB}</th><th rowspan="2">dBm/$BW_{Channel}$</th><th rowspan="2">dBm/$BW_{Channel}$</th></tr>
<tr><th>SCS_{SSB} = 15 kHz</th><th>SCS_{SSB} = 30 kHz</th></tr>
<tr><td rowspan="8">±4.5</td><td rowspan="8">±6</td><td rowspan="8">≥-6</td><td>NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A</td><td>-121</td><td>-118</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_B</td><td>-120.5</td><td>-117.5</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_TDD_FR1_C</td><td>-120</td><td>-117</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_D, NR_TDD_FR1_D</td><td>-119.5</td><td>-116.5</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_E, NR_TDD_FR1_E</td><td>-119</td><td>-116</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_F</td><td>-118.5</td><td>-115.5</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_G</td><td>-118</td><td>-115</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_H</td><td>-117.5</td><td>-114.5</td><td>N/A</td><td>-50</td></tr>
<tr><td colspan="8">NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.</td></tr>
</table>

10.1.4.2 Void

10.1.5 Inter-frequency RSRP accuracy requirements for FR2

10.1.5.1 Inter-frequency SS-RSRP accuracy requirements

10.1.5.1.1 Absolute SS-RSRP Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRP in this clause apply to a cell on a frequency in FR2 that is on a different frequency than the serving cell.

The accuracy requirements in Table 10.1.5.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.5.1.1-1: SS-RSRP Inter frequency absolute accuracy in FR2

<table>
<tr><th colspan="2">Accuracy</th><th colspan="5">Conditions</th></tr>
<tr><th rowspan="2">Normal condition</th><th rowspan="2">Extreme condition</th><th rowspan="2">SSB Ês/Iot</th><th colspan="4">Io Note 2 range</th></tr>
<tr><th colspan="3">Minimum Io</th><th>Maximum Io</th></tr>
<tr><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2">dB</th><th colspan="2">dBm / SCS_{SSB} Note 1</th><th rowspan="2">dBm/$BW_{Channel}$</th><th rowspan="2">dBm/$BW_{Channel}$</th></tr>
<tr><th>SCS_{SSB} = 120kHz</th><th>SCS_{SSB} = 240kHz</th></tr>
<tr><td>±6</td><td>±9</td><td rowspan="2">≥-4</td><td colspan="2">Same value as SSB_RP in Table B.2.3-2, according to UE Power class, operating band and angle of arrival</td><td>N/A</td><td>-70</td></tr>
<tr><td>±8</td><td>±11</td><td colspan="2">N/A</td><td>-70</td><td>-50</td></tr>
<tr><td colspan="7">Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.</td></tr>
</table>

10.1.5.1.2 Relative SS-RSRP Accuracy

The relative accuracy of SS-RSRP is defined as the SS-RSRP measured from one cell on a frequency in FR2 compared to the SS-RSRP measured from another cell on another frequency in FR2.

The accuracy requirements in Table 10.1.5.1.2-1 are valid under the following conditions:

- Conditions defined in 38.101-2 [19] Clause 7.3 for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $|SSB\_RP1_{dBm} - SSB\_RP2_{dBm}| \leqslant 27dB$
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.5.1.2-1: SS-RSRP Inter frequency relative accuracy in FR2

<table>
<tr><th colspan="2">Accuracy</th><th colspan="4">Conditions</th></tr>
<tr><th rowspan="2">Normal condition</th><th rowspan="2">Extreme condition</th><th rowspan="2">SSB Ês/Iot</th><th colspan="3">Io Note 2 range</th></tr>
<tr><th colspan="2">Minimum Io</th><th>Maximum Io</th></tr>
<tr><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2">dB</th><th colspan="2">dBm / SCS_{SSB} Note 1</th><th rowspan="2">dBm/$BW_{Channel}$</th></tr>
<tr><th>SCS_{SSB} = 120kHz</th><th>SCS_{SSB} = 240kHz</th></tr>
<tr><td>±6</td><td>±9</td><td>≥-4</td><td colspan="2">Same value as SSB_RP in Table B.2.3-2, according to UE Power class, operating band and angle of arrival</td><td>-50</td></tr>
<tr><td colspan="6">Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
Note 4: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.</td></tr>
</table>

10.1.5.2 Void

10.1.6 RSRP Measurement Report Mapping

The reporting range of SS-RSRP for L3 reporting is defined from -156 dBm to -31 dBm with 1 dB resolution. The reporting range of SS-RSRP and CSI-RSRP for L1 reporting is defined from -140 to -44 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 10.1.6.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

The reporting range of differential SS-RSRP and CSI-RSRP for L1 reporting is defined from 0 dBm to -30 dB with 2 dB resolution.

The mapping of measured quantity is defined in Table 10.1.6.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.6.1-1: SS-RSRP and CSI-RSRP measurement report mapping

Reported value	Measured quantity value (L3 SS-RSRP)	Measured quantity value (L1 SS-RSRP and CSI-RSRP)	Unit
RSRP_0	SS-RSRP<-156	Not valid	dBm
RSRP_1	-156⩽ SS-RSRP<-155	Not valid	dBm
RSRP_2	-155⩽ SS-RSRP<-154	Not valid	dBm
RSRP_3	-154⩽ SS-RSRP<-153	Not valid	dBm
RSRP_4	-153⩽ SS-RSRP<-152	Not valid	dBm
RSRP_5	-152⩽ SS-RSRP<-151	Not valid	dBm
RSRP_6	-151⩽ SS-RSRP<-150	Not valid	dBm
RSRP_7	-150⩽ SS-RSRP<-149	Not valid	dBm
RSRP_8	-149⩽ SS-RSRP<-148	Not valid	dBm
RSRP_9	-148⩽ SS-RSRP<-147	Not valid	dBm
RSRP_10	-147⩽ SS-RSRP<-146	Not valid	dBm
RSRP_11	-146⩽ SS-RSRP<-145	Not valid	dBm
RSRP_12	-145⩽ SS-RSRP<-144	Not valid	dBm
RSRP_13	-144⩽ SS-RSRP<-143	Not valid	dBm
RSRP_14	-143⩽ SS-RSRP<-142	Not valid	dBm
RSRP_15	-142⩽ SS-RSRP<-141	Not valid	dBm
RSRP_16	-141⩽ SS-RSRP<-140	RSRP<-140	dBm
RSRP_17	-140⩽ SS-RSRP<-139	-140⩽RSRP<-139	dBm
RSRP_18	-139⩽ SS-RSRP<-138	-139⩽ RSRP<-138	dBm
…	…		…
RSRP_111	-46⩽ SS-RSRP<-45	-46⩽ RSRP<-45	dBm
RSRP_112	-45⩽ SS-RSRP<-44	-45⩽ RSRP<-44	dBm
RSRP_113	-44⩽ SS-RSRP<-43	-44⩽ RSRP	dBm
RSRP_114	-43⩽ SS-RSRP<-42	Not valid	dBm
RSRP_115	-42⩽ SS-RSRP<-41	Not valid	dBm
RSRP_116	-41⩽ SS-RSRP<-40	Not valid	dBm
RSRP_117	-40⩽ SS-RSRP<-39	Not valid	dBm
RSRP_118	-39⩽ SS-RSRP<-38	Not valid	dBm
RSRP_119	-38⩽ SS-RSRP<-37	Not valid	dBm
RSRP_120	-37⩽ SS-RSRP<-36	Not valid	dBm
RSRP_121	-36⩽ SS-RSRP<-35	Not valid	dBm
RSRP_122	-35⩽ SS-RSRP<-34	Not valid	dBm
RSRP_123	-34⩽ SS-RSRP<-33	Not valid	dBm
RSRP_124	-33⩽ SS-RSRP<-32	Not valid	dBm
RSRP_125	-32⩽ SS-RSRP<-31	Not valid	dBm
RSRP_126	-31⩽ SS-RSRP	Not valid	dBm
RSRP_127 (Note)	Infinity	Infinity	dBm
Note: The value of RSRP_127 is applicable for RSRP threshold configured by the network as defined in TS 38.331 [2], but not for the purpose of measurement reporting.			

Table 10.1.6.1-2: Differential SS-RSRP and CSI-RSRP measurement (for L1 reporting) report mapping

Reported value	Measured quantity value (difference in measured RSRP from strongest RSRP)	Unit
DIFFRSRP_0	0⩾ΔRSRP>-2	dB
DIFFRSRP_1	-2⩾ΔRSRP>-4	dB
DIFFRSRP_2	-4⩾ΔRSRP>-6	dB
DIFFRSRP_3	-6⩾ΔRSRP>-8	dB
DIFFRSRP_4	-8⩾ΔRSRP>-10	dB
DIFFRSRP_5	-10⩾ΔRSRP>-12	dB
DIFFRSRP_6	-12⩾ΔRSRP>-14	dB
DIFFRSRP_7	-14⩾ΔRSRP>-16	dB
DIFFRSRP_8	-16⩾ΔRSRP>-18	dB
DIFFRSRP_9	-18⩾ΔRSRP>-20	dB
DIFFRSRP_10	-20⩾ΔRSRP>-22	dB
DIFFRSRP_11	-22⩾ΔRSRP>-24	dB
DIFFRSRP_12	-24⩾ΔRSRP>-26	dB
DIFFRSRP_13	-26⩾ΔRSRP>-28	dB
DIFFRSRP_14	-28⩾ΔRSRP>-30	dB
DIFFRSRP_15	-30⩾ΔRSRP	dB

10.1.7 Intra-frequency RSRQ accuracy requirements for FR1

10.1.7.1 Intra-frequency SS-RSRQ accuracy requirements in FR1

10.1.7.1.1 Absolute SS-RSRQ Accuracy in FR1

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on the same frequency as that of the serving cell in FR1. The accuracy requirements in this clause are also applicable when *highSpeedMeasFlag-r16* is configured.

The accuracy requirements in Table 10.1.7.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.

Table 10.1.7.1.1-1: SS-RSRQ Intra frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range				
			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2.5	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.8 Intra-frequency RSRQ accuracy requirements for FR2

10.1.8.1 Intra-frequency SS-RSRQ accuracy requirements in FR2

10.1.8.1.1 Absolute SS-RSRQ Accuracy in FR2

Unless otherwise specified, the requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 10.1.8.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.8.1.1-1: SS-RSRQ Intra frequency absolute accuracy in FR2

<table>
<tr><th colspan="2">Accuracy</th><th colspan="4">Conditions</th></tr>
<tr><th rowspan="2">Normal condition</th><th rowspan="2">Extreme condition</th><th rowspan="2">SSB Ês/Iot</th><th colspan="3">Io Note 2 range</th></tr>
<tr><th colspan="2">Minimum Io</th><th>Maximum Io</th></tr>
<tr><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2">dB</th><th colspan="2">dBm / SCS_{SSB} Note 1</th><th rowspan="2">dBm/$BW_{Channel}$</th></tr>
<tr><th>SCS_{SSB} = 120kHz</th><th>SCS_{SSB} = 240kHz</th></tr>
<tr><td>±2.5</td><td>±4</td><td>⩾-3</td><td colspan="2" rowspan="2">Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival</td><td rowspan="2">-50</td></tr>
<tr><td>±3.5</td><td>±4</td><td>≥-6</td></tr>
<tr><td colspan="6">Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.</td></tr>
</table>

10.1.9 Inter-frequency RSRQ accuracy requirements for FR1

10.1.9.1 Inter-frequency SS-RSRQ accuracy requirements in FR1

10.1.9.1.1 Aboslute Accuracy of SS-RSRQ in FR1

The requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.9.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.

Table 10.1.9.1.1-1: SS-RSRQ Inter frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range				
			NR operating band groups Note 3	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±2.5	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 3: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.9.1.2 Relative Accuracy of SS-RSRQ in FR1

The relative accuracy of SS-RSRQ in inter frequency case is defined as the RSRQ measured from one cell on a frequency in FR1 compared to the RSRP measured from another cell on a different frequency in FR1.

The accuracy requirements in Table 10.1.9.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $|SSB\_RP1_{dBm} - SSB\_RP2_{dBm}| \leqslant 27$ dB
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1.9.1.2-1: SS-RSRQ Inter frequency relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
±4	±4	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.10 Inter-frequency RSRQ accuracy requirements for FR2

10.1.10.1 Inter-frequency SS-RSRQ accuracy requirements in FR2

10.1.10.1.1 Aboslute Accuracy of SS-RSRQ in FR2

The requirements for absolute accuracy of SS-RSRQ in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.10.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.10.1.1-1: SS-RSRQ Inter frequency absolute accuracy in FR2

<table>
<tr><th colspan="2">Accuracy</th><th colspan="4">Conditions</th></tr>
<tr><th rowspan="2">Normal condition</th><th rowspan="2">Extreme condition</th><th rowspan="2">SSB Ês/Iot</th><th colspan="3">Io Note 2 range</th></tr>
<tr><th colspan="2">Minimum Io</th><th>Maximum Io</th></tr>
<tr><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2">dB</th><th colspan="2">dBm / SCS_{SSB} Note 1</th><th rowspan="2">dBm/BW_{Channel}</th></tr>
<tr><th>SCS_{SSB} = 120kHz</th><th>SCS_{SSB} = 240kHz</th></tr>
<tr><td>±2.5</td><td>±4</td><td>≥-3</td><td colspan="2" rowspan="2">Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival</td><td rowspan="2">-50</td></tr>
<tr><td>±3.5</td><td>±4</td><td>≥-4</td></tr>
<tr><td colspan="6">Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.</td></tr>
</table>

10.1.10.1.2 Relative Accuracy of SS-RSRQ in FR2

The relative accuracy of SS-RSRQ in inter frequency case is defined as the RSRQ measured from one cell on a frequency in FR2 compared to the RSRP measured from another cell on a different frequency in FR2.

The accuracy requirements in Table 10.1.10.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band for each relevant SSB.
- $|SSB\_RP1_{dBm} - SSB\_RP2_{dBm}| \leq 27$ dB
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.10.1.2-1: SS-RSRQ Inter frequency relative accuracy in FR2

<table>
<tr><th colspan="2">Accuracy</th><th colspan="4">Conditions</th></tr>
<tr><th rowspan="2">Normal condition</th><th rowspan="2">Extreme condition</th><th rowspan="2">SSB Ês/Iot</th><th colspan="3">Io Note 2 range</th></tr>
<tr><th colspan="2">Minimum Io</th><th>Maximum Io</th></tr>
<tr><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2">dB</th><th colspan="2">dBm / SCS_{SSB} Note 1</th><th rowspan="2">dBm/BW_{Channel}</th></tr>
<tr><th>SCS_{SSB} = 120kHz</th><th>SCS_{SSB} = 240kHz</th></tr>
<tr><td>±3</td><td>±4</td><td>≥-3</td><td colspan="2" rowspan="2">Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival</td><td rowspan="2">-50</td></tr>
<tr><td>±4</td><td>±4</td><td>≥-4</td></tr>
<tr><td colspan="6">Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
Note 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.</td></tr>
</table>

10.1.11 RSRQ report mapping

10.1.11.1 SS-RSRQ measurement report mapping

The reporting range of SS-RSRQ is defined from -43 dB to 20 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 10.1.11.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.11.1-1: SS-RSRQ measurement report mapping

Reported value	Measured quantity value	Unit
SS-RSRQ_0	SS-RSRQ<-43	dB
SS-RSRQ_1	-43⩽ SS-RSRQ<-42.5	dB
SS-RSRQ_2	-42.5⩽ SS-RSRQ<-42	dB
SS-RSRQ_3	-42⩽ SS-RSRQ<-41.5	dB
SS-RSRQ_4	-41.5⩽ SS-RSRQ<-41	dB
..	..	…
SS-RSRQ_122	17.5⩽ SS-RSRQ<18	dB
SS-RSRQ_123	18⩽ SS-RSRQ<18.5	dB
SS-RSRQ_124	18.5⩽ SS-RSRQ<19	dB
SS-RSRQ_125	19⩽ SS-RSRQ<19.5	dB
SS-RSRQ_126	19.5⩽ SS-RSRQ<20	dB
SS-RSRQ_127	20 ⩽ SS-RSRQ	dB

10.1.12 Intra-frequency SINR accuracy requirements for FR1

10.1.12.1 Intra-frequency SS-SINR accuracy requirements in FR1

10.1.12.1.1 Absolute SS-SINR Accuracy in FR1

Unless otherwise specified, the requirements for absolute accuracy of SS-SINR in this clause apply to a cell on the same frequency as that of the serving cell in FR1.

The accuracy requirements in Table 10.1.12.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band.

Table 10.1.12.1.1-1: SS-SINR Intra frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3.0	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.
NOTE 3: The requirements apply for SSB Ês/Iot ⩽ 25 dB under non-HST scenarios.
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.
NOTE 5: The requirements apply for SSB Ês/Iot ⩽5 dB with SCS 15kHz or 30kHz under NR high speed scenarios.

10.1.13 Intra-frequency SINR accuracy requirements for FR2

10.1.13.1 Intra-frequency SS-SINR accuracy requirements in FR2

10.1.13.1.1 Absolute SS-SINR Accuracy in FR2

Unless otherwise specified, the requirements for absolute accuracy of SS-SINR in this clause apply to a cell on the same frequency as that of the serving cell in FR2.

The accuracy requirements in Table 10.1.13.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for intra-frequency measurements are fulfilled according to Annex B.2.2 for a corresponding Band.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.13.1.1-1: SS-SINR Intra frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1		dBm/$BW_{Channel}$
			SCS_{SSB} = 120kHz	SCS_{SSB} = 240kHz	
±3	±4	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival		-50
±3.5	±4	≥-6			

Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
Note 4: The requirements apply for SSB Ês/Iot ⩽ 25 dB.

10.1.14 Inter-frequency SINR accuracy requirements for FR1

10.1.14.1 Inter-frequency SS-SINR accuracy requirements in FR1

10.1.14.1.1 Aboslute Accuracy of SS-SINR in FR1

The requirements for absolute accuracy of SS-SINR in this clause apply to a cell on a frequency in FR1 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.14.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.

Table 10.1.14.1.1-1: SS-SINR Inter frequency absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 3	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3.0	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
±3.5	±4	≥-6	Note 2	Note 2	Note 2	Note 2	Note 2
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 3: The requirements apply for SSB Ês/Iot ⩽ 25 dB. NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.14.1.2 Relative Accuracy of SS-SINR in FR1

The relative accuracy of SS-SINR in inter frequency case is defined as the SS-SINR measured from one cell on a frequency in FR1 compared to the SS-SINR measured from another cell on a different frequency in FR1.

The accuracy requirements in Table 10.1.14.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.
- $|SSB\_RP1_{dBm} - SSB\_RP2_{dBm}| \leqslant 27$ dB
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB

Table 10.1.14.1.2-1: SS-SINR Inter frequency relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2,4	Io Note 1 range				
			NR operating band groups Note 5	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 120 kHz	SCS_{SSB} = 240 kHz		
±3.5	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50
±4	±4	≥-6	Note 3	Note 3	Note 3	Note 3	Note 3
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies. NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement. NOTE 4: The requirements apply for SSB Ês/Iot ⩽ [25] dB. NOTE 5: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.15 Inter-frequency SINR accuracy requirements for FR2

10.1.15.1 Inter-frequency SS-SINR accuracy requirements in FR2

10.1.15.1.1 Aboslute Accuracy of SS-SINR in FR2

The requirements for absolute accuracy of SS-SINR in this clause apply to a cell on a frequency in FR2 that has different carrier frequency from the serving cell.

The accuracy requirements in Table 10.1.15.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.15.1.1-1: SS-SINR Inter frequency absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1		$dBm/BW_{Channel}$
			SCS_{SSB} = 120kHz	SCS_{SSB} = 240kHz	
±3	±4	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival		-50
±3.5	±4	≥-4			

Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
Note 4: The requirements apply for SSB Ês/Iot ≤ 25 dB.

10.1.15.1.2 Relative Accuracy of SS-SINR in FR2

The relative accuracy of SS-SINR in inter frequency case is defined as the SS-SINR measured from one cell on a frequency in FR2 compared to the SS-SINR measured from another cell on a different frequency in FR2.

The accuracy requirements in Table 10.1.15.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for inter-frequency measurements are fulfilled according to Annex B.2.3 for a corresponding Band.
- $|SSB\_RP1_{dBm} - SSB\_RP2_{dBm}| \leq 27$ dB
- | Channel 1_Io -Channel 2_Io | ≤ 20 dB
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.15.1.2-1: SS-SINR Inter frequency relative accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 2 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 1		$dBm/BW_{Channel}$
			SCS_{SSB} = 120kHz	SCS_{SSB} = 240kHz	
±3.5	±4	≥-3	Same value as SSB_RP in Table B.2.2-2, according to UE Power class, operating band and angle of arrival		-50
±4	±4	≥-6			

Note 1: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
Note 2: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
Note 3: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of cells to which the requirement applies.
Note 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.
Note 5: The requirements apply for SSB Ês/Iot ≤ 25 dB.

10.1.16 SINR report mapping

10.1.16.1 SS-SINR and CSI-SINR measurement report mapping

The reporting range of SS-SINR and CSI-SINR is defined from -23 dB to 40 dB with 0.5 dB resolution. The mapping of measured quantity is defined in Table 10.1.16.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

The reporting range of differential SS-SINR and CSI-SINR for L1 reporting is defined from -15 dB to 0 dB with 1 dB resolution.

The mapping of measured quantity is defined in Table 10.1.16.1-2. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.16.1-1: SS-SINR and CSI-RSRP measurement report mapping

Reported value	Measured quantity value (L3 SS-SINR)	Measured quantity value (L1 SS-SINR and L1 CSI-SINR)	Unit
SINR_0	SS-SINR<-23	SINR<-23	dB
SINR_1	-23⩽ SS-SINR<-22.5	-23⩽SINR<-22.5	dB
SINR_2	-22.5⩽ SS-SINR<-22	-22.5⩽SINR<-22	dB
SINR_3	-22⩽ SS-SINR<-21.5	-22⩽SINR<-21.5	dB
SINR_4	-21.5⩽ SS-SINR<-21	-21.5⩽SINR<-21	dB
..	..	..	…
SINR_123	38⩽ SS-SINR<38.5	38⩽SINR<38.5	dB
SINR_124	38.5⩽ SS-SINR<39	38.5⩽SINR<39	dB
SINR_125	39⩽ SS-SINR<39.5	39⩽SINR<39.5	dB
SINR_126	39.5⩽ SS-SINR<40	39.5⩽SINR<40	dB
SINR_127	40⩽ SS-SINR	40⩽SINR	dB

Table 10.1.16.1-2: Differential SS-SINR and CSI-SINR measurement (for L1 reporting) report mapping

Reported value	Measured quantity value (difference in measured SINR from largest SINR)	Unit
DIFFSINR_0	0⩾ΔSINR>-1	dB
DIFFSINR_1	-1⩾ΔSINR>-2	dB
DIFFSINR_2	-2⩾ΔSINR>-3	dB
DIFFSINR_3	-3⩾ΔSINR>-4	dB
DIFFSINR_4	-4⩾ΔSINR>-5	dB
DIFFSINR_5	-5⩾ΔSINR>-6	dB
DIFFSINR_6	-6⩾ΔSINR>-7	dB
DIFFSINR_7	-7⩾ΔSINR>-8	dB
DIFFSINR_8	-8⩾ΔSINR>-9	dB
DIFFSINR_9	-9⩾ΔSINR>-10	dB
DIFFSINR_10	-10⩾ΔSINR>-11	dB
DIFFSINR_11	-11⩾ΔSINR>-12	dB
DIFFSINR_12	-12⩾ΔSINR>-13	dB
DIFFSINR_13	-13⩾ΔSINR>-14	dB
DIFFSINR_14	-14⩾ΔSINR>-15	dB
DIFFSINR_15	-15⩾ΔSINR	dB

10.1.17 Power Headroom

10.1.17.1 Power Headroom Report

10.1.17.1.1 Power Headroom Report Mapping

The power headroom reporting range is from -32 ...+38 dB. Table 10.1.17.1-1 defines the report mapping.

Table 10.1.17.1-1: Power headroom report mapping

Reported value	Measured quantity value (dB)
POWER_HEADROOM_0	PH < -32
POWER_HEADROOM_1	-32 ≤ PH < -31
POWER_HEADROOM_2	-31 ≤ PH < -30
POWER_HEADROOM_3	-30 ≤ PH < -29
…	…
POWER_HEADROOM_53	20 ≤ PH < 21
POWER_HEADROOM_54	21 ≤ PH < 22
POWER_HEADROOM_55	22 ≤ PH < 24
POWER_HEADROOM_56	24 ≤ PH < 26
POWER_HEADROOM_57	26 ≤ PH < 28
POWER_HEADROOM_58	28 ≤ PH < 30
POWER_HEADROOM_59	30 ≤ PH < 32
POWER_HEADROOM_60	32 ≤ PH < 34
POWER_HEADROOM_61	34 ≤ PH < 36
POWER_HEADROOM_62	36 ≤ PH < 38
POWER_HEADROOM_63	PH ⩾ 38

10.1.18 $P_{CMAX,c,f}$

The UE is required to report the UE configured maximum output power ($P_{CMAX,c,f}$) together with the power headroom. This clause defines the requirements for the $P_{CMAX,c,f}$ reporting.

10.1.18.1 Report Mapping

The $P_{CMAX,c,f}$ reporting range is defined from -29 dBm to 33 dBm with 1 dB resolution. Table 10.1.18.1-1 defines the reporting mapping.

Table 10.1.18.1-1 Mapping of $P_{CMAX,c.f}$

Reported value	Measured quantity value	Unit
PCMAX_C_00	$P_{CMAX,c,f} < -29$	dBm
PCMAX_C_01	$-29 \le P_{CMAX,c,f} < -28$	dBm
PCMAX_C_02	$-28 \le P_{CMAX,c,f} < -27$	dBm
…	…	…
PCMAX_C_61	$31 \le P_{CMAX,c,f} < 32$	dBm
PCMAX_C_62	$32 \le P_{CMAX,c,f} < 33$	dBm
PCMAX_C_63	$33 \le P_{CMAX,c,f}$	dBm

10.1.19 L1-RSRP accuracy requirements for FR1

10.1.19.1 SSB based L1-RSRP accuracy requirements

10.1.19.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 10.1.19.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.

Table 10.1.19.1.1-1: SSB based L1-RSRP absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range				
			NR operating band groups Note 2	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±5.0	±9.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-70
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-70
			NR_TDD_FR1_C	-120	-117	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-70
			NR_FDD_FR1_G	-118	-115	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-70
±8.5	±11.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_FDD_FR1_H,	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.							

10.1.19.1.2 Relative Accuracy

The relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell.

The accuracy requirements in Table 10.1.19.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.

Table 10.1.19.1.2-1: SSB based L1-RSRP relative accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	SSB Ês/Iot Note 2	Io Note 1 range				
			NR operating band groups Note 4	Minimum Io			Maximum Io
dB	dB	dB		dBm / SCS_{SSB}		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz		
±3	±4	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	N/A	-50
			NR_FDD_FR1_B	-120.5	-117.5	N/A	-50
			NR_TDD_FR1_C	-120	-117	N/A	-50
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	N/A	-50
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	N/A	-50
			NR_FDD_FR1_F	-118.5	-115.5	N/A	-50
			NR_FDD_FR1_G	-118	-115	N/A	-50
			NR_FDD_FR1_H	-117.5	-114.5	N/A	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies.
NOTE 3: Void
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.

10.1.19.2 CSI-RS based L1-RSRP accuracy requirements

10.1.19.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-RSRP in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 10.1.19.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.19.2.1-1.

Table 10.1.19.2.1-1: CSI-RS based L1-RSRP absolute accuracy in FR1

Accuracy		Conditions						
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 1 range					
			NR operating band groups Note 2	Minimum Io				Maximum Io
dB	dB	dB		dBm / SCS_{CSI-RS}			dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
				SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz		
±5.0	±9.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-121	-118	-115	N/A	-70
			NR_FDD_FR1_B	-120.5	-117.5	-114.5	N/A	-70
			NR_TDD_FR1_C	-120	-117	-114	N/A	-70
			NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-113.5	N/A	-70
			NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-113	N/A	-70
			NR_FDD_FR1_F	-118.5	-115.5	-112.5	N/A	-70
			NR_FDD_FR1_G	-118	-115	-112	N/A	-70
			NR_FDD_FR1_H	-117.5	-114.5	-111.5	N/A	-70
±8.5	±11.5	≥-3	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A, NR_FDD_FR1_B, NR_TDD_FR1_C, NR_FDD_FR1_D, NR_TDD_FR1_D, NR_FDD_FR1_E, NR_TDD_FR1_E, NR_FDD_FR1_F, NR_FDD_FR1_G, NR_FDD_FR1_H	N/A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.								

10.1.19.2.2 Relative Accuracy

The relative accuracy of CSI-RS based L1-RSRP is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in Table 10.1.19.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.19.2.2-1.

Table 10.1.19.2.2-1: CSI-RS based L1-RSRP relative accuracy in FR1

<table>
<tr><th colspan="2">Accuracy</th><th colspan="7">Conditions</th></tr>
<tr><th rowspan="2">Normal condition</th><th rowspan="2">Extreme condition</th><th rowspan="2">CSI-RS Ês/Iot Note 2</th><th colspan="6">Io Note 1 range</th></tr>
<tr><th>NR operating band groups Note 4</th><th colspan="4">Minimum Io</th><th>Maximum Io</th></tr>
<tr><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2">dB</th><th rowspan="2"></th><th colspan="3">dBm / SCS_{CSI-RS}</th><th rowspan="2">dBm/BW_{Channel}</th><th rowspan="2">dBm/BW_{Channel}</th></tr>
<tr><th>SCS_{CSI-RS} = 15 kHz</th><th>SCS_{CSI-RS} = 30 kHz</th><th>SCS_{CSI-RS} = 60 kHz</th></tr>
<tr><td rowspan="8">±3</td><td rowspan="8">±4</td><td rowspan="8">≥-3</td><td>NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A</td><td>-121</td><td>-118</td><td>-115</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_B</td><td>-120.5</td><td>-117.5</td><td>-114.5</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_TDD_FR1_C</td><td>-120</td><td>-117</td><td>-114</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_D, NR_TDD_FR1_D</td><td>-119.5</td><td>-116.5</td><td>-113.5</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_E, NR_TDD_FR1_E</td><td>-119</td><td>-116</td><td>-113</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_F</td><td>-118.5</td><td>-115.5</td><td>-112.5</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_G</td><td>-118</td><td>-115</td><td>-112</td><td>N/A</td><td>-50</td></tr>
<tr><td>NR_FDD_FR1_H</td><td>-117.5</td><td>-114.5</td><td>-111.5</td><td>N/A</td><td>-50</td></tr>
<tr><td colspan="9">NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Void
NOTE 4: NR operating band groups in FR1 are as defined in clause 3.5.2.</td></tr>
</table>

10.1.20 L1-RSRP accuracy requirements for FR2

10.1.20.1 SSB based L1-RSRP accuracy requirements

10.1.20.1.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of SSB based L1-RSRP in this clause apply to all SSBs of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 10.1.20.1.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.20.1.1-1: SSB based L1-RSRP absolute accuracy in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range			
			Minimum Io			Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 2		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{SSB} = 120kHz	SCS_{SSB} = 240kHz		
±6.5	±9.5	≥-3	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±8.5	±11.5	≥-3	N/A		-70	-50
NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth. NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.						

10.1.20.1.2 Relative Accuracy

The relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the largest measured value of L1-RSRP among all SSBs of the serving cell.

The accuracy requirements in Table 10.1.20.1.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.1 for a corresponding Band for each relevant SSB.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.20.1.2-1: SSB based L1-RSRP relative accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	SSB Ês/Iot	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{SSB} Note 3		dBm/$BW_{Channel}$
			SCS_{SSB} = 120kHz	SCS_{SSB} = 240kHz	
±6.5	±9.5	≥-3	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival		-50
NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth. NOTE 2: The parameter SSB Ês/Iot is the minimum SSB Ês/Iot of the pair of SSBs to which the requirement applies. NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 4: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.					

10.1.20.2 CSI-RS based L1-RSRP accuracy requirements

10.1.20.2.1 Absolute Accuracy

Unless otherwise specified, the requirements for absolute accuracy of CSI-RS based L1-RSRP in this clause apply to all CSI-RS resources of the serving cell configured for L1-RSRP measurement.

The accuracy requirements in Table 10.1.20.2.1-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.20.2.1-1.

Table 10.1.20.2.1-1: CSI-RS based L1-RSRP absolute accuracy in FR2

Accuracy		Conditions				
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 1 range			
			Minimum Io			Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS} Note 2		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
			SCS_{CSI-RS} = 60kHz	SCS_{CSI-RS} = 120kHz		
±6.5	±9.5	≥-3	Same value as CSI-RS_RP in Table B.2.4.2-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±8.5	±11.5	≥-3	N/A		-70	-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 3: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.20.2.2 Relative Accuracy

The relative accuracy of CSI-RS based L1-RSRP is defined as the L1-RSRP measured from one CSI-RS compared to the largest measured value of L1-RSRP among all CSI-RS resources of the serving cell.

The accuracy requirements in Table 10.1.20.2.2-1 are valid under the following conditions:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Conditions for L1-RSRP measurements are fulfilled according to Annex B.2.4.2 for a corresponding Band for each relevant CSI-RS.
- The bandwidth of CSI-RS is 48 PRBs and the density is 3.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

The performance with larger bandwidth of CSI-RS is equal to or better than the accuracy requirements in Table 10.1.20.2.2-1.

Table 10.1.20.2.2-1: CSI-RS based L1-RSRP relative accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	CSI-RS Ês/Iot	Io Note 1 range		
			Minimum Io		Maximum Io
dB	dB	dB	dBm / SCS_{CSI-RS}		$dBm/BW_{Channel}$
			SCS_{CSI-RS} = 60kHz	SCS_{CSI-RS} = 120kHz	
±6.5	±9.5	≥-3	Same value as CSI-RS RP in Table B.2.4.2-2, according to UE Power class, operating band and angle of arrival		-50

NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth.
NOTE 2: The parameter CSI-RS Ês/Iot is the minimum CSI-RS Ês/Iot of the pair of CSI-RS resources to which the requirement applies.
NOTE 3: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival.
NOTE 4: In the test cases, the CSI-RS Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.

10.1.21 SFTD accuracy requirements

10.1.21.1 SFTD acuracy requirements for NE-DC

The SFN and frame timing difference (SFTD) is measured between PCell and E-UTRAN PSCell under NE-DC.

The accuracy requirements in Table 10.1.21.1-4 are appilicable under the following conditions:

For FR1 PCell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Io range deifined in Table 10.1.21.1-1.

Table 10.1.21.1-1: PCell Io range conditions in FR1

Parameter	Io Note 1 range			
	NR operating band groups Note 4, 5	Minimum Io Note 2, 3		Maximum Io
		dBm/ SCS_{SSB}		$dBm/BW_{Channel}$
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A	-121	-118	-50
	NR_FDD_FR1_B	-120.5	-117.5	-50
	NR_TDD_FR1_C	-120	-117	-50
	NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-50
	NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-50
	NR_FDD_FR1_F	-118.5	-115.5	-50
	NR_FDD_FR1_G	-118	-115	-50
	NR_FDD_FR1_H	-117.5	-114.5	-50

NOTE 1: Io is assumed to have constant EPRE across the bandwidth.
NOTE 2: The condition level is increased by $\Delta R_{IB,c}$ as defined in clause 7.3B in TS 38.101-3 [20], depending on E-UTRA – NR band combination.
NOTE 3: The condition level is increased by MSD as defined in clause 7.3B in TS 38.101-3 [20], if applicable depending on E-UTRA – NR band combination.
NOTE 4: NR operating band groups are as defined in clause 3.5.
NOTE 5: Only NR bands within EN-DC band combinations as specified in clause 5.5B in TS 38.101-3 [20] are applicable.

For FR2 PCell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Io range deifined in Table 10.1.21.1-2.

Table 10.1.21.1-2: PCell Io range conditions in FR2

Parameter	Io Note 1 range		
	Minimum Io Note 2, 3		Maximum Io
	dBm/ SCS_{SSB}		dBm/$BW_{Channel}$
	SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth and specified at the Reference point. NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.			

For E-UTRA PSCell SFN and frame timing measurement:

- Cell specific reference signals are transmitted either from one, two or four antenna ports.
- Conditions defined in TS 36.101 [25] Clause 7.3 for reference sensitivity are fulfilled.
- No changes to the uplink transmission timing are applied during the measurement period.
- $RSRP|_{dBm}$ according to Annex B.3.5 in TS 36.101 [25] for a corresponding Band.
- Io range deifined in Table 10.1.21.1-3.

Table 10.1.21.1-3: E-UTRA PSCell Io range conditions

Parameter	Io Note 1 range		
	E-UTRA operating band groups Note 3	Minimum Io	Maximum Io
Conditions		dBm/15kHz Note 2	dBm/$BW_{Channel}$
	FDD_A, TDD_A	-121	-50
	FDD_C, TDD_C	-120	-50
	FDD_D	-119.5	-50
	FDD_E, TDD_E	-119	-50
	FDD_F	-118.5	-50
	FDD_G	-118	-50
	FDD_H	-117.5	-50
	FDD_N	-114.5	-50
NOTE 1: When in dBm/15kHz, the minimum Io condition is expressed as the average Io per RE over all REs in that symbol. Io may be different in different symbols within a subframe. NOTE 2: The condition level is increased by Δ>0, when applicable, as described in clauses B.4.2 and B.4.3 in TS36.133 [15]. NOTE 3: E-UTRA operating band groups are as defined in clause 3.5 in TS 36.133 [15].			

Table 10.1.21.1-4: SFTD measurement accuracy

Accuracy	Conditions	
	Ês/Iot Note 2	Frequency range
Ts Note 1	dB	
40*64*Tc	≥-3	FR1
40*64*Tc		FR2
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.		

10.1.21.2 SFTD acuracy requirements for NR-DC

The SFN and frame timing difference (SFTD) is measured between PCell in FR1 and PSCell in FR2 under NR dual connectivity.

The accuracy requirements in Table 10.1.21.2-3 are appilicable under the following conditions:

For FR1 PCell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Io range deifined in Table 10.1.21.2-1.

Table 10.1.21.2-1: PCell Io range conditions in FR1

Parameter	Io Note 1 range			
	NR operating band groups Note 2	Minimum Io		Maximum Io
		dBm/ SCS_{SSB}		dBm/$BW_{Channel}$
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A	-121	-118	-50
	NR_FDD_FR1_B	-120.5	-117.5	-50
	NR_TDD_FR1_C	-120	-117	-50
	NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-50
	NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-50
	NR_FDD_FR1_F	-118.5	-115.5	-50
	NR_FDD_FR1_G	-118	-115	-50
	NR_FDD_FR1_H	-117.5	-114.5	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups are as defined in clause 3.5.2.				

For FR2 PSCell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Io range deifined in Table 10.1.21.2-2.
- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.21.2-2: PSCell Io range conditions in FR2

Parameter	Io Note 1 range		
	Minimum Io Note 2, 3		Maximum Io
	dBm/ SCS_{SSB}		dBm/$BW_{Channel}$
	SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth and specified at the Reference point. NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.			

Table 10.1.21.2-3: SFTD measurement accuracy

Accuracy	Conditions	
	Ês/Iot Note 2	Frequency range
Ts Note 1	dB	
40*64*Tc	≥ -3	Between FR1 and FR2
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.		

10.1.21.3 Inter frequency SFTD acuracy requirements

The SFN and frame timing difference (SFTD) is measured between PCell and inter-frequency neighbour cell.

The accuracy requirements in Table 10.1.21.3-3 are appilicable under the following conditions:

For FR1 PCell, inter frequency neighbour cell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Io range deifined in Table 10.1.21.3-1.

Table 10.1.21.3-1: PCell, inter frequency neighbour cell Io range conditions in FR1

Parameter	Io Note 1 range			
	NR operating band groups Note 2	Minimum Io		Maximum Io
		dBm/ SCS_{SSB}		dBm/$BW_{Channel}$
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A	-121	-118	-50
	NR_FDD_FR1_B	-120.5	-117.5	-50
	NR_TDD_FR1_C	-120	-117	-50
	NR_FDD_FR1_D, NR_TDD_FR1_D	-119.5	-116.5	-50
	NR_FDD_FR1_E, NR_TDD_FR1_E	-119	-116	-50
	NR_FDD_FR1_F	-118.5	-115.5	-50
	NR_FDD_FR1_G	-118	-115	-50
	NR_FDD_FR1_H	-117.5	-114.5	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups are as defined in clause 3.5.2.				

For FR2 PCell, inter frequency neighbour cell SFN and frame timing measurement:

- Conditions defined in clause 7.3 of TS 38.101-2 [19] for reference sensitivity are fulfilled.
- Io range deifined in Table 10.1.21.3-2.

- The measured signals are in the directions covered by the percentile EIS spherical coverage of the UE, defined in clause 7.3.4 of TS 38.101-2 [19].

Table 10.1.21.3-2: PCell, inter frequency neighbour cell Io range conditions in FR2

Parameter	Io Note 1 range		
	Minimum Io Note 2, 3		Maximum Io
	dBm/ SCS_{SSB}		dBm/$BW_{Channel}$
	SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	Same value as SSB_RP in Table B.2.4.1-2, according to UE Power class, operating band and angle of arrival	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth and specified at the Reference point. NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.			

Table 10.1.21.3-3: Inter frequency SFTD measurement accuracy

Accuracy	Conditions	
	Ês/Iot Note 2	Frequency range
Ts Note 1	dB	
40*64*Tc	≥ -3	FR1, FR2
NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]. NOTE 2: The parameter Ês/Iot is the minimum Ês/Iot of the pair of cells to which the requirement applies.		

10.1.22 CLI measurement accuracy requirements

10.1.22.1 SRS-RSRP

10.1.22.1.1 SRS-RSRP Accuracy

The SRS-RSRP measurement reported by the UE shall fulfil the accuracy requirements defined in Table 10.1.22.1.1-1 for FR1 and Table 10.1.22.1.1-2 for FR2, provided that the following conditions are met. The accuracy requirements in this clause are derived based on AWGN radio propagation conditions.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.
- Conditions for SRS-RSRP measurements are fulfilled according to Annex B.2.z for a corresponding Band for each relevant SRS resource configured for measurement.
- The time difference between UE's DL reference timing in the serving cell and SRS arrival time is no larger than $T_{error\_SRS\_RSRP}$, where
  - $T_{error\_SRS\_RSRP} = T_C \times N_{TA\_offset}$ + 4.67us for FR1
  - $T_{error\_SRS\_RSRP} = T_C \times N_{TA\_offset}$ + 3.67us for FR2
  - N_{TA_offset} is defined in Table 7.1.2-2
  - T_C is 0.509ns
- The number of SRS ports in the SRS resource configured for measurement is 1,
- The number of symbols in the SRS resource configured for measurement is 1,
- The number of repetitions in the SRS resource configured for measurement is 1,

- Frequency hopping, sequence group hopping or sequence hopping is disabled in the SRS resource configured for measurement,
- The bandwidth of the SRS resource is 48 PRBs.
- One of the following conditions is met
  - There is no other SRS resource with the same root sequence and on the same symbol and with same comb as the relevant SRS resource.
  - If multiple SRS resources are on the same symbol and with same comb, the distance between cyclic shifts of any two resources is no less than 6 if transmissionComb = n4, and no less than 4 if transmissionComb = n2.

Table 10.1.22.1.1-1: SRS-RSRP absolute accuracy in FR1

Accuracy						Conditions						
Normal condition			Extreme condition			SRS Ês/Iot	Io Note 1 range					
							NR operating band groups Note 2	Minimum Io				Maximum Io
dB						dB		dBm / SCS_{SRS}			dBm/BW Channel	dBm/BW Channel
SCS_{SRS} (kHz)			SCS_{SRS} (kHz)									
15	30	60	15	30	60			SCS_{SRS} = 15 kHz	SCS_{SRS} = 30 kHz	SCS_{SRS} = 60 kHz		
±3	±3.5	±5	±7.5	±8	±9.5	≥1	NR_TDD_FR1_A,	-120	-117	-114	N/A	-70
							NR_TDD_FR1_C	-119	-116	-113	N/A	-70
							NR_TDD_FR1_D	-118.5	-115.5	-112.5	N/A	-70
							NR_TDD_FR1_E	-118	-115	-112	N/A	-70
±6.5	±7	±8.5	±9.5	±10	±11.5	≥1	NR_TDD_FR1_A, NR_TDD_FR1_C, NR_TDD_FR1_D, NR_TDD_FR1_E	N/A	N/A	N/A	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2.												

Table 10.1.22.1.1-2: SRS-RSRP absolute accuracy in FR2

Accuracy				Conditions				
Normal condition		Extreme condition		SRS Ês/Iot	Io Note 1 range			
					Minimum Io			Maximum Io
dB				dB	dBm / SCS_{SRS} Note 2		$dBm/BW_{Channel}$	$dBm/BW_{Channel}$
SCS_{SRS} (kHz)		SCS_{SRS} (kHz)			SCS_{SRS} = 60kHz	SCS_{SRS} = 120kHz		
60	120	60	120					
±6	±8.5	±9	±11.5	≥1	Same value as SRS_RP in Table B.2.7-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±9	±11.5	±11	±13.5	≥1	N/A		-70	-50
NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth. NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table.								

10.1.22.1.2 SRS-RSRP report mapping

The reporting range of SRS-RSRP is defined from -140 dBm to -44 dBm with 1 dB resolution. The mapping of measured quantity is defined in Table 10.1.22.1.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.22.1.2-1: SRS-RSRP measurement report mapping

Reported value	Measured quantity value	Unit
SRS-RSRP_0	SRS-RSRP<-140	dBm
SRS-RSRP_1	-140≤ SRS-RSRP<-139	dBm
SRS-RSRP_2	-139≤ SRS-RSRP<-138	dBm
SRS-RSRP_3	-138≤ SRS-RSRP<-137	dBm
SRS-RSRP_4	-137≤ SRS-RSRP<-136	dBm
..	..	…
SRS-RSRP_95	-46≤ SRS-RSRP<-45	dBm
SRS-RSRP_96	-45≤ SRS-RSRP<-44	dBm
SRS-RSRP_97	-44≤ SRS-RSRP	dBm
SRS-RSRP_98	Infinity	
Note: 'Infinity' means that UE cannot detect SRS due to too strong signal to measure.		

10.1.22.2 CLI-RSSI

10.1.22.2.1 CLI-RSSI Accuracy

The CLI-RSSI measurement reported by the UE shall fulfil the accuracy requirements defined in Table 10.1.22.2.1-1 for FR1 and Table 10.1.22.2.1-2 for FR2, provided that the following conditions are met.

- Conditions defined in clause 7.3 of TS 38.101-1 [18] for reference sensitivity are fulfilled.

Table 10.1.22.2.1-1: CLI-RSSI absolute accuracy in FR1

Accuracy		Conditions					
Normal condition	Extreme condition	Io Note 1 range					
		NR operating band groups Note 2	Minimum Io				Maximum Io
dB	dB		dBm / SCS_{SRS}			dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
			SCS_{SRS} = 15 kHz	SCS_{SRS} = 30 kHz	SCS_{SRS} = 60 kHz		
±3.5	±6.5	NR_TDD_FR1_A,	-120	-117	-114	N/A	-70
		NR_TDD_FR1_C	-119	-116	-113	N/A	-70
		NR_TDD_FR1_D	-118.5	-115.5	-112.5	N/A	-70
		NR_TDD_FR1_E	-118	-115	-112	N/A	-70
±5.5	±8.5	Note 3	Note 3	Note 3	Note 3	-70	-50
NOTE 1: Io is assumed to have constant EPRE across the bandwidth. NOTE 2: NR operating band groups in FR1 are as defined in clause 3.5.2. NOTE 3: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.							

Table 10.1.22.2.1-2: CLI-RSSI absolute accuracy in FR2

Accuracy		Conditions			
Normal condition	Extreme condition	Io Note 1 range			
		Minimum Io			Maximum Io
dB	dB	dBm / SCS_{SRS} Note 2		dBm/$BW_{Channel}$	dBm/$BW_{Channel}$
		SCS_{SRS} = 60kHz	SCS_{SRS} = 120kHz		
±5	±8	Same value as SRS_RP in Table B.2.7-2, according to UE Power class, operating band and angle of arrival		N/A	-70
±7	±10	Note 4		-70	-50
NOTE 1: Io specified at the Reference point, and assumed to have constant EPRE across the bandwidth. NOTE 2: Values based on Refsens and EIS spherical coverage as defined in clauses 7.3.2 and 7.3.4 of TS 38.101-2 [19]. Applicable side condition selected depending on angle of arrival. NOTE 3: In the test cases, the SSB Ês/Iot and related parameters may need to be adjusted to ensure Ês/Iot at UE baseband is above the value defined in this table. NOTE 4: The same bands and the same Io conditions for each band apply for this requirement as for the corresponding highest accuracy requirement.					

10.1.22.2.2 CLI-RSSI report mapping

The reporting range of CLI-RSSI is defined from -100 dBm to -25 dBm with 1 dB resolution. The mapping of measured quantity is defined in Table 10.1.22.2.2-1. The range in the signalling may be larger than the guaranteed accuracy range. UE shall scale the measured CLI-RSSI to report a nominal RSSI equivalent to 6RB measurement with 15kHz SCS.

Table 10.1.22.2.2-1: CLI-RSSI measurement report mapping

Reported value	Measured quantity value	Unit
CLI-RSSI_00	CLI-RSSI < -100	dBm
CLI-RSSI_01	-100 ≤ CLI-RSSI < -99	dBm
CLI-RSSI_02	-99 ≤ CLI-RSSI < -98	dBm
…	…	…
CLI-RSSI_74	-27 ≤ CLI-RSSI < -26	dBm
CLI-RSSI_75	-26 ≤ CLI-RSSI < -25	dBm
CLI-RSSI_76	-25 ≤ CLI-RSSI	dBm

10.1.24.3.1 Absolute PRS-RSRP Measurement Report Mapping

The reporting range of absolute PRS-RSRP measurement is defined from -156 dBm to -31 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 10.1.24.3.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.24.3.1-1: Measurement report mapping for PRS-RSRP

Reported value	Measured quantity value	Unit
PRS_RSRP_0	PRS-RSRP<-156	dBm
PRS_RSRP_1	-156≤PRS-RSRP<-155	dBm
PRS_RSRP_2	-155≤PRS-RSRP<-154	dBm
PRS_RSRP_3	-154≤PRS-RSRP<-153	dBm
PRS_RSRP_4	-153≤PRS-RSRP<-152	dBm
PRS_RSRP_5	-152≤PRS-RSRP<-151	dBm
PRS_RSRP_6	-151≤PRS-RSRP<-150	dBm
PRS_RSRP_7	-150≤PRS-RSRP<-149	dBm
PRS_RSRP_8	-149≤PRS-RSRP<-148	dBm
PRS_RSRP_9	-148≤PRS-RSRP<-147	dBm
PRS_RSRP_10	-147≤PRS-RSRP<-146	dBm
PRS_RSRP_11	-146≤PRS-RSRP<-145	dBm
PRS_RSRP_12	-145≤PRS-RSRP<-144	dBm
PRS_RSRP_13	-144≤PRS-RSRP<-143	dBm
PRS_RSRP_14	-143≤PRS-RSRP<-142	dBm
PRS_RSRP_15	-142≤PRS-RSRP<-141	dBm
PRS_RSRP_16	-141≤PRS-RSRP<-140	dBm
PRS_RSRP_17	-140≤PRS-RSRP<-139	dBm
PRS_RSRP_18	-139≤PRS-RSRP<-138	dBm
…	…	…
PRS_RSRP_111	-46≤PRS-RSRP<-45	dBm
PRS_RSRP_112	-45≤PRS-RSRP<-44	dBm
PRS_RSRP_113	-44≤PRS-RSRP<-43	dBm
PRS_RSRP_114	-43≤PRS-RSRP<-42	dBm
PRS_RSRP_115	-42≤PRS-RSRP<-41	dBm
PRS_RSRP_116	-41≤PRS-RSRP<-40	dBm
PRS_RSRP_117	-40≤PRS-RSRP<-39	dBm
PRS_RSRP_118	-39≤PRS-RSRP<-38	dBm
PRS_RSRP_119	-38≤PRS-RSRP<-37	dBm
PRS_RSRP_120	-37≤PRS-RSRP<-36	dBm
PRS_RSRP_121	-36≤PRS-RSRP<-35	dBm
PRS_RSRP_122	-35≤PRS-RSRP<-34	dBm
PRS_RSRP_123	-34≤PRS-RSRP<-33	dBm
PRS_RSRP_124	-33≤PRS-RSRP<-32	dBm
PRS_RSRP_125	-32≤PRS-RSRP<-31	dBm
PRS_RSRP_126	-31≤PRS-RSRP	dBm

10.1.24.3.2 Differential Report Mapping for PRS-RSRP Measurement

The reporting range of differential PRS-RSRP is defined from -30 dB to 0 dB with 1 dB resolution when *nr-DL-AoD-RequestLocationInformation* message is received.

The mapping of measured quantity is defined in Table 10.1.24.3.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

The reporting range of differential PRS-RSRP is defined from -30 dB to 30 dB with 1 dB resolution when *nr-DL-TDOA-RequestLocationInformation* or *nr-Multi-RTT-RequestLocationInformation* is received.

The mapping of measured quantity is defined in Table 10.1.24.3.2-2. The range in the signalling may be larger than the guaranteed accuracy range or the range supported by the UE receiver for differentail RSRP measured on different PRS resources in frequency domain at the same time.

Table 10.1.24.3.2-1: Measurement report mapping for differential PRS-RSRP

Reported value	Measured quantity value	Unit
DIFFRSRP_0	-30⩾ΔRSRP	dB
DIFFRSRP_1	-29⩾ΔRSRP>-30	dB
DIFFRSRP_2	-28⩾ΔRSRP>-29	dB
DIFFRSRP_3	-27⩾ΔRSRP>-28	dB
DIFFRSRP_4	-26⩾ΔRSRP>-27	dB
DIFFRSRP_5	-25⩾ΔRSRP>-26	dB
DIFFRSRP_6	-24⩾ΔRSRP>-25	dB
DIFFRSRP_7	-23⩾ΔRSRP>-24	dB
DIFFRSRP_8	-22⩾ΔRSRP>-23	dB
DIFFRSRP_9	-21⩾ΔRSRP>-22	dB
DIFFRSRP_10	-20⩾ΔRSRP>-21	dB
DIFFRSRP_11	-19⩾ΔRSRP>-20	dB
DIFFRSRP_12	-18⩾ΔRSRP>-19	dB
DIFFRSRP_13	-17⩾ΔRSRP>-18	dB
DIFFRSRP_14	-16⩾ΔRSRP>-17	dB
DIFFRSRP_15	-15⩾ΔRSRP>-16	dB
DIFFRSRP_16	-14⩾ΔRSRP>-15	dB
DIFFRSRP_17	-13⩾ΔRSRP>-14	dB
DIFFRSRP_18	-12⩾ΔRSRP>-13	dB
DIFFRSRP_19	-11⩾ΔRSRP>-12	dB
DIFFRSRP_20	-10⩾ΔRSRP>-11	dB
DIFFRSRP_21	-9⩾ΔRSRP>-10	dB
DIFFRSRP_22	-8⩾ΔRSRP>-9	dB
DIFFRSRP_23	-7⩾ΔRSRP>-8	dB
DIFFRSRP_24	-6⩾ΔRSRP>-7	dB
DIFFRSRP_25	-5⩾ΔRSRP>-6	dB
DIFFRSRP_26	-4⩾ΔRSRP>-5	dB
DIFFRSRP_27	-3⩾ΔRSRP>-4	dB
DIFFRSRP_28	-2⩾ΔRSRP>-3	dB
DIFFRSRP_29	-1⩾ΔRSRP>-2	dB
DIFFRSRP_30	0⩾ΔRSRP>-1	dB

Table 10.1.24.3.2-2: Measurement report mapping for differential PRS-RSRP

Reported value	Measured quantity value	Unit
DIFFRSRP_0	-30⩾ΔRSRP	dB
DIFFRSRP_1	-29⩾ΔRSRP>-30	dB
DIFFRSRP_2	-28⩾ΔRSRP>-29	dB
DIFFRSRP_3	-27⩾ΔRSRP>-28	dB
DIFFRSRP_4	-26⩾ΔRSRP>-27	dB
DIFFRSRP_5	-25⩾ΔRSRP>-26	dB
DIFFRSRP_6	-24⩾ΔRSRP>-25	dB
DIFFRSRP_7	-23⩾ΔRSRP>-24	dB
DIFFRSRP_8	-22⩾ΔRSRP>-23	dB
DIFFRSRP_9	-21⩾ΔRSRP>-22	dB
DIFFRSRP_10	-20⩾ΔRSRP>-21	dB
DIFFRSRP_11	-19⩾ΔRSRP>-20	dB
DIFFRSRP_12	-18⩾ΔRSRP>-19	dB
DIFFRSRP_13	-17⩾ΔRSRP>-18	dB
DIFFRSRP_14	-16⩾ΔRSRP>-17	dB
…	…	…
DIFFRSRP_25	-5⩾ΔRSRP>-6	dB
DIFFRSRP_26	-4⩾ΔRSRP>-5	dB
DIFFRSRP_27	-3⩾ΔRSRP>-4	dB
DIFFRSRP_28	-2⩾ΔRSRP>-3	dB
DIFFRSRP_29	-1⩾ΔRSRP>-2	dB
DIFFRSRP_30	0⩾ΔRSRP>-1	dB
DIFFRSRP_31	1⩾ΔRSRP>0	dB
DIFFRSRP_32	2⩾ΔRSRP>1	dB
DIFFRSRP_33	3⩾ΔRSRP>2	dB
DIFFRSRP_34	4⩾ΔRSRP>3	dB
DIFFRSRP_35	5⩾ΔRSRP>4	dB
DIFFRSRP_36	6⩾ΔRSRP>5	dB
…	…	…
DIFFRSRP_47	17⩾ΔRSRP>16	dB
DIFFRSRP_48	18⩾ΔRSRP>17	dB
DIFFRSRP_49	19⩾ΔRSRP>18	dB
DIFFRSRP_50	20⩾ΔRSRP>19	dB
DIFFRSRP_51	21⩾ΔRSRP>20	dB
DIFFRSRP_52	22⩾ΔRSRP>21	dB
DIFFRSRP_53	23⩾ΔRSRP>-22	dB
DIFFRSRP_54	24⩾ΔRSRP>23	dB
DIFFRSRP_55	25⩾ΔRSRP>24	dB
DIFFRSRP_56	26⩾ΔRSRP>25	dB
DIFFRSRP_57	27⩾ΔRSRP>26	dB
DIFFRSRP_58	28⩾ΔRSRP>27	dB
DIFFRSRP_59	29⩾ΔRSRP>28	dB
DIFFRSRP_60	30⩾ΔRSRP>29	dB
DIFFRSRP_61	ΔRSRP>30	dB

10.1.23 RSTD Measurements

10.1.23.1 Introduction

The requirements in Clause 10.1.23 shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* message from LMF via LPP [31] requesting the UE to report one or more DL RSTD measurements defined in TS 38.215 [4].

10.1.23.2 Measurement Accuracy Requirements

10.1.23.3 Report mapping

10.1.23.3.1 Absolute DL RSTD Measurement Reporting

The reporting range for the DL RSTD measurement is defined from $-985024\times T_c$ to $985024\times T_c$ with the resolution step of $2^k\times T_c$, where

T_c is defined in TS 38.211 [6],

$k_{min}\leq k\leq k_{max}$,

k_{min}=[2] and k_{max}=5, when configured PRS resource of at least one of the reference cell and neighbor cell measured for the RSTD measurement is in FR1,

k_{min}=0 and k_{max}=5, when configured PRS resource of both the reference cell and neighbor cell measured for the RSTD measurement are in FR2,

$k\geq$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the RSTD measurement.

The measurement report mapping for different k values are specified in Tables 10.1.23.3.1-1 – 10.1.23.3.1-6.

Table 10.1.23.3.1-1: Report mapping for *k*=0

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_0000000	RSTD < -985024	T_c
RSTD_0000001	-985024 ≤ RSTD < -985023	T_c
RSTD_0000002	-985023 ≤ RSTD < -985022	T_c
…	…	…
RSTD_0985024	-1 ≤ RSTD < 0	T_c
RSTD_0985025	0 ≤ RSTD < 1	T_c
…	…	…
RSTD_1970047	985022 ≤ RSTD < 985023	T_c
RSTD_1970048	985023 ≤ RSTD < 985024	T_c
RSTD_1970049	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-2: Report mapping for *k*=1

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_000000	RSTD < -985024	T_c
RSTD_000001	-985024 ≤ RSTD < -985022	T_c
RSTD_000002	-985022 ≤ RSTD < -985020	T_c
…	…	…
RSTD_492512	-2 ≤ RSTD < 0	T_c
RSTD_492513	0 ≤ RSTD < 2	T_c
…	…	…
RSTD_985023	985020 ≤ RSTD < 985022	T_c
RSTD_985024	985022 ≤ RSTD < 985024	T_c
RSTD_985025	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-3: Report mapping for *k*=2

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_000000	RSTD < -985024	T_c
RSTD_000001	-985024 ≤ RSTD < -985020	T_c
RSTD_000002	-985020 ≤ RSTD < -985016	T_c
…	…	…
RSTD_246256	-4 ≤ RSTD < 0	T_c
RSTD_246257	0 ≤ RSTD < 4	T_c
…	…	…
RSTD_492511	985016 ≤ RSTD < 985020	T_c
RSTD_492512	985020 ≤ RSTD < 985024	T_c
RSTD_492513	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-4: Report mapping for *k*=3

Reported Quantity Value RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_000000	RSTD < -985024	T_c
RSTD_000001	-985024 ≤ RSTD < -985016	T_c
RSTD_000002	-985016 ≤ RSTD < -985008	T_c
…	…	…
RSTD_123128	-8 ≤ RSTD < 0	T_c
RSTD_123129	0 ≤ RSTD < 8	T_c
…	…	…
RSTD_246255	985008 ≤ RSTD < 985016	T_c
RSTD_246256	985016 ≤ RSTD < 985024	T_c
RSTD_246257	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-5: Report mapping for *k*=4

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_000000	RSTD < -985024	T_c
RSTD_000001	-985024 ≤ RSTD < -985008	T_c
RSTD_000002	-985008 ≤ RSTD < -984992	T_c
…	…	…
RSTD_061564	-16 ≤ RSTD < 0	T_c
RSTD_061565	0 ≤ RSTD < 16	T_c
…	…	…
RSTD_123127	984992 ≤ RSTD < 985008	T_c
RSTD_123128	985008 ≤ RSTD < 985024	T_c
RSTD_123129	985024 ≤ RSTD	T_c

Table 10.1.23.3.1-6: Report mapping for *k*=5

Reported Quantity Value, RSTD_i	Measured Quantity Value, RSTD	Unit
RSTD_00000	RSTD < -985024	T_c
RSTD_00001	-985024 ≤ RSTD < -984992	T_c
RSTD_00002	-984992 ≤ RSTD < -984960	T_c
…	…	…
RSTD_30782	-32 ≤ RSTD < 0	T_c
RSTD_30783	0 ≤ RSTD < 32	T_c
…	…	…
RSTD_61563	984960 ≤ RSTD < 984992	T_c
RSTD_61564	984992 ≤ RSTD < 985024	T_c
RSTD_61565	985024 ≤ RSTD	T_c

10.1.23.3.2 Differential Reporting for DL RSTD Measurement

A first DL RSTD measurement is reported by means of differential reporting, i.e. as ΔRSTD, relative to a second DL RSTD measurement (RSTD2), provided that:

- the absolute measured quantity value of the second DL RSTD measurement (RSTD2) is not larger than the absolute measured quantity value of the first DL RSTD measurement (RSTD1), i.e., ΔRSTD=RSTD1-RSTD2≥0, and

- the absolute value of the second DL RSTD measurement (RSTD2) is reported together with ΔRSTD for the first DL RSTD measurement.

The reporting range for differential reporting ΔRSTD of the first DL RSTD measurement is defined from 0 up to $8191\times T_c$ with the resolution step of $2^k\times T_c$, where

T_c is defined in TS 38.211 [6],

$k_{min}\le k\le k_{max}$,

k_{min}=[2] and k_{max}=5, when configured PRS resource of at least one of the reference cell and neighbor cell measured for the first RSTD measurement or second RSTD measurement is in FR1,

k_{min}=0 and k_{max}=5, when configured PRS resource of both the reference cell and neighbor cell measured for both of the first RSTD measurement and the second RSTD measurement are in FR2,

$k\ge$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the RSTD measurement.

The measurement report mapping for different *k* values are specified in Tables 10.1.23.3.2-1 – 10.1.23.3.2-6.

Table 10.1.23.3.2-1: Report mapping for *k*=0

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_0000	0 ≤ ΔRSTD < 1	T_c
DIFFRSTD_0001	1 ≤ ΔRSTD < 2	T_c
DIFFRSTD_0002	2 ≤ ΔRSTD < 3	T_c
…	…	…
DIFFRSTD_8189	8189 ≤ ΔRSTD < 8190	T_c
DIFFRSTD_8190	8190 ≤ ΔRSTD < 8191	T_c
DIFFRSTD_8191	8191 ≤ ΔRSTD	T_c

Table 10.1.23.3.2-2: Report mapping for *k*=1

Reported Quantity Value, DIFFRSTD_i	∆RSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_0000	$0 \le \Delta RSTD < 2$	T_c
DIFFRSTD_0001	$2 \le \Delta RSTD < 4$	T_c
DIFFRSTD_0002	$4 \le \Delta RSTD < 6$	T_c
…	…	…
DIFFRSTD_4093	$8186 \le \Delta RSTD < 8188$	T_c
DIFFRSTD_4094	$8188 \le \Delta RSTD < 8190$	T_c
DIFFRSTD_4095	$8190 \le \Delta RSTD$	T_c

Table 10.1.23.3.2-3: Report mapping for *k*=2

Reported Quantity Value, DIFFRSTD_i	∆RSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_0000	$0 \le \Delta RSTD < 4$	T_c
DIFFRSTD_0001	$4 \le \Delta RSTD < 8$	T_c
DIFFRSTD_0002	$8 \le \Delta RSTD < 12$	T_c
…	…	…
DIFFRSTD_2045	$8180 \le \Delta RSTD < 8184$	T_c
DIFFRSTD_2046	$8184 \le \Delta RSTD < 8188$	T_c
DIFFRSTD_2047	$8188 \le \Delta RSTD$	T_c

Table 10.1.23.3.2-4: Report mapping for *k*=3

Reported Quantity Value, DIFFRSTD_i	∆RSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_0000	$0 \le \Delta RSTD < 8$	T_c
DIFFRSTD_0001	$8 \le \Delta RSTD < 16$	T_c
DIFFRSTD_0002	$16 \le \Delta RSTD < 24$	T_c
…	…	…
DIFFRSTD_1021	$8168 \le \Delta RSTD < 8176$	T_c
DIFFRSTD_1022	$8176 \le \Delta RSTD < 8184$	T_c
DIFFRSTD_1023	$8184 \le \Delta RSTD$	T_c

Table 10.1.23.3.2-5: Report mapping for *k*=4

Reported Quantity Value, DIFFRSTD_i	∆RSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_000	$0 \le \Delta RSTD < 16$	T_c
DIFFRSTD_001	$16 \le \Delta RSTD < 32$	T_c
DIFFRSTD_002	$32 \le \Delta RSTD < 48$	T_c
…	…	…
DIFFRSTD_509	$8144 \le \Delta RSTD < 8160$	T_c
DIFFRSTD_510	$8160 \le \Delta RSTD < 8176$	T_c
DIFFRSTD_511	$8176 \le \Delta RSTD$	T_c

Table 10.1.23.3.2-6: Report mapping for *k*=5

Reported Quantity Value, DIFFRSTD_i	ΔRSTD = RSTD1 – RSTD2	Unit
DIFFRSTD_000	0 ≤ ΔRSTD < 32	T_c
DIFFRSTD_001	32 ≤ ΔRSTD < 64	T_c
DIFFRSTD_002	64 ≤ ΔRSTD < 96	T_c
…	…	…
DIFFRSTD_253	8096 ≤ ΔRSTD < 8128	T_c
DIFFRSTD_254	8128 ≤ ΔRSTD < 8160	T_c
DIFFRSTD_255	8160 ≤ ΔRSTD	T_c

10.1.23.3.3 Additional Path Report Mapping for DL RSTD

The reporting range for the additional path reporting for an RSTD measurement is defined up to the range from -8175×T_c to 8175×T_c with the resolution step of 2^k×T_c, where

T_c is defined in TS 38.211 [6],

k_{min}≤k≤k_{max},

k_{min}=[2] and k_{max}=5, when configured PRS resource of at least one of the reference cell and neighbor cell measured for the RSTD measurement is in FR1,

k_{min}=0 and k_{max}=5, when configured PRS resource of both the reference cell and neighbor cell measured for the RSTD measurement are in FR2,

k≥ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the RSTD measurement.

The UE can report the timing of up to two additional paths with respect to the path timing determining the RSTD measurement.

The report mappings for different *k* values are specified in Tables 10.1.23.3.3-1 – 10.1.23.3.3-6.

Table 10.1.23.3.3-1: Report mapping for *k*=0

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174	T_c
path_00002	-8174 ≤ Δpath < -8173	T_c
…	…	…
path_08175	-1 ≤ Δpath < 0	T_c
path_08176	0 ≤ Δpath < 1	T_c
…	…	…
path_ 16349	8173 ≤ Δpath < 8174	T_c
path_ 16350	8174 ≤ Δpath < 8175	T_c
path_ 16351	8175 ≤ Δpath	T_c

Table 10.1.23.3.3-2: Report mapping for *k*=1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8175	T_c
path_0001	-8175 ≤ Δpath < -8173	T_c
path_0002	-8173 ≤ Δpath < -8171	T_c
…	…	…
path_4088	-1 ≤ Δpath < 1	T_c
…	…	…
path_8174	8171 ≤ Δpath < 8173	T_c
path_8175	8173 ≤ Δpath < 8175	T_c
path_8176	8175 ≤ Δpath	T_c

Table 10.1.23.3.3-3: Report mapping for *k*=2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8174	T_c
path_0001	-8174 ≤ Δpath < -8170	T_c
path_0002	-8170 ≤ Δpath < -8166	T_c
…	…	…
path_2044	-2 ≤ Δpath < 2	T_c
…	…	…
path_4086	8166 ≤ Δpath < 8170	T_c
path_4087	8170 ≤ Δpath < 8174	T_c
path_4088	8174 ≤ Δpath	T_c

Table 10.1.23.3.3-4: Report mapping for *k*=3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8172	T_c
path_0001	-8172 ≤ Δpath < -8164	T_c
path_0002	-8164 ≤ Δpath < -8156	T_c
…	…	…
path_1022	-4 ≤ Δpath < 4	T_c
…	…	…
path_2042	8156 ≤ Δpath < 8164	T_c
path_2043	8164 ≤ Δpath < 8172	T_c
path_2044	8172 ≤ Δpath	T_c

Table 10.1.23.3.3-5: Report mapping for *k*=4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8168	T_c
path_0001	-8168 ≤ Δpath < -8152	T_c
path_0002	-8152 ≤ Δpath < -8136	T_c
…	…	…
path_511	-8 ≤ Δpath < 8	T_c
…	…	…
path_1020	8136 ≤ Δpath < 8152	T_c
path_1021	8152 ≤ Δpath < 8168	T_c
path_1022	8168 ≤ Δpath	T_c

Table 10.1.23.3.3-6: Report mapping for *k*=5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000	Δpath < -8160	T_c
path_001	-8160 ≤ Δpath < -8128	T_c
path_002	-8128 ≤ Δpath < -8096	T_c
…	…	…
path_256	0 ≤ Δpath < 32	T_c
…	…	…
path_509	8096 ≤ Δpath < 8128	T_c
path_510	8128 ≤ Δpath < 8160	T_c
path_511	8160 ≤ Δpath	T_c

10.1.24 PRS-RSRP Measurements

10.1.24.1 Introduction

The requirements in Clause 10.1.24 shall apply, provided the UE has received *nr-DL-TDOA-RequestLocationInformation* or *nr-Multi-RTT-RequestLocationInformation* or *nr-DL-AoD-RequestLocationInformation* message from LMF via LPP [31] requesting the UE to report one or more DL PRS-RSRP measurements defined in TS 38.215 [4].

10.1.24.2 Measurement Accuracy Requirements

10.1.24.3 Report mapping

10.1.24.3.1 Absolute PRS-RSRP Measurement Report Mapping

The reporting range of absolute PRS-RSRP measurement is defined from -156 dBm to -31 dBm with 1 dB resolution.

The mapping of measured quantity is defined in Table 10.1.24.3.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 10.1.24.3.1-1: Measurement report mapping for PRS-RSRP

Reported value	Measured quantity value	Unit
PRS_RSRP_0	PRS-RSRP<-156	dBm
PRS_RSRP_1	-156≤PRS-RSRP<-155	dBm
PRS_RSRP_2	-155≤PRS-RSRP<-154	dBm
PRS_RSRP_3	-154≤PRS-RSRP<-153	dBm
PRS_RSRP_4	-153≤PRS-RSRP<-152	dBm
PRS_RSRP_5	-152≤PRS-RSRP<-151	dBm
PRS_RSRP_6	-151≤PRS-RSRP<-150	dBm
PRS_RSRP_7	-150≤PRS-RSRP<-149	dBm
PRS_RSRP_8	-149≤PRS-RSRP<-148	dBm
PRS_RSRP_9	-148≤PRS-RSRP<-147	dBm
PRS_RSRP_10	-147≤PRS-RSRP<-146	dBm
PRS_RSRP_11	-146≤PRS-RSRP<-145	dBm
PRS_RSRP_12	-145≤PRS-RSRP<-144	dBm
PRS_RSRP_13	-144≤PRS-RSRP<-143	dBm
PRS_RSRP_14	-143≤PRS-RSRP<-142	dBm
PRS_RSRP_15	-142≤PRS-RSRP<-141	dBm
PRS_RSRP_16	-141≤PRS-RSRP<-140	dBm
PRS_RSRP_17	-140≤PRS-RSRP<-139	dBm
PRS_RSRP_18	-139≤PRS-RSRP<-138	dBm
…	…	…
PRS_RSRP_111	-46≤PRS-RSRP<-45	dBm
PRS_RSRP_112	-45≤PRS-RSRP<-44	dBm
PRS_RSRP_113	-44≤PRS-RSRP<-43	dBm
PRS_RSRP_114	-43≤PRS-RSRP<-42	dBm
PRS_RSRP_115	-42≤PRS-RSRP<-41	dBm
PRS_RSRP_116	-41≤PRS-RSRP<-40	dBm
PRS_RSRP_117	-40≤PRS-RSRP<-39	dBm
PRS_RSRP_118	-39≤PRS-RSRP<-38	dBm
PRS_RSRP_119	-38≤PRS-RSRP<-37	dBm
PRS_RSRP_120	-37≤PRS-RSRP<-36	dBm
PRS_RSRP_121	-36≤PRS-RSRP<-35	dBm
PRS_RSRP_122	-35≤PRS-RSRP<-34	dBm
PRS_RSRP_123	-34≤PRS-RSRP<-33	dBm
PRS_RSRP_124	-33≤PRS-RSRP<-32	dBm
PRS_RSRP_125	-32≤PRS-RSRP<-31	dBm
PRS_RSRP_126	-31≤PRS-RSRP	dBm

10.1.24.3.2 Differential Report Mapping for PRS-RSRP Measurement

The reporting range of differential PRS-RSRP is defined from -30 dB to 0 dB with 1 dB resolution when *nr-DL-AoD-RequestLocationInformation* message is received.

The mapping of measured quantity is defined in Table 10.1.24.3.2-1. The range in the signalling may be larger than the guaranteed accuracy range.

The reporting range of differential PRS-RSRP is defined from -30 dB to 30 dB with 1 dB resolution when *nr-DL-TDOA-RequestLocationInformation* or *nr-Multi-RTT-RequestLocationInformation* is received.

The mapping of measured quantity is defined in Table 10.1.24.3.2-2. The range in the signalling may be larger than the guaranteed accuracy range or the range supported by the UE receiver for differentail RSRP measured on different PRS resources in frequency domain at the same time.

Table 10.1.24.3.2-1: Measurement report mapping for differential PRS-RSRP

Reported value	Measured quantity value	Unit
DIFFRSRP_0	-30⩾ΔRSRP	dB
DIFFRSRP_1	-29⩾ΔRSRP>-30	dB
DIFFRSRP_2	-28⩾ΔRSRP>-29	dB
DIFFRSRP_3	-27⩾ΔRSRP>-28	dB
DIFFRSRP_4	-26⩾ΔRSRP>-27	dB
DIFFRSRP_5	-25⩾ΔRSRP>-26	dB
DIFFRSRP_6	-24⩾ΔRSRP>-25	dB
DIFFRSRP_7	-23⩾ΔRSRP>-24	dB
DIFFRSRP_8	-22⩾ΔRSRP>-23	dB
DIFFRSRP_9	-21⩾ΔRSRP>-22	dB
DIFFRSRP_10	-20⩾ΔRSRP>-21	dB
DIFFRSRP_11	-19⩾ΔRSRP>-20	dB
DIFFRSRP_12	-18⩾ΔRSRP>-19	dB
DIFFRSRP_13	-17⩾ΔRSRP>-18	dB
DIFFRSRP_14	-16⩾ΔRSRP>-17	dB
DIFFRSRP_15	-15⩾ΔRSRP>-16	dB
DIFFRSRP_16	-14⩾ΔRSRP>-15	dB
DIFFRSRP_17	-13⩾ΔRSRP>-14	dB
DIFFRSRP_18	-12⩾ΔRSRP>-13	dB
DIFFRSRP_19	-11⩾ΔRSRP>-12	dB
DIFFRSRP_20	-10⩾ΔRSRP>-11	dB
DIFFRSRP_21	-9⩾ΔRSRP>-10	dB
DIFFRSRP_22	-8⩾ΔRSRP>-9	dB
DIFFRSRP_23	-7⩾ΔRSRP>-8	dB
DIFFRSRP_24	-6⩾ΔRSRP>-7	dB
DIFFRSRP_25	-5⩾ΔRSRP>-6	dB
DIFFRSRP_26	-4⩾ΔRSRP>-5	dB
DIFFRSRP_27	-3⩾ΔRSRP>-4	dB
DIFFRSRP_28	-2⩾ΔRSRP>-3	dB
DIFFRSRP_29	-1⩾ΔRSRP>-2	dB
DIFFRSRP_30	0⩾ΔRSRP>-1	dB

Table 10.1.24.3.2-2: Measurement report mapping for differential PRS-RSRP

Reported value	Measured quantity value	Unit
DIFFRSRP_0	-30≥ΔRSRP	dB
DIFFRSRP_1	-29≥ΔRSRP>-30	dB
DIFFRSRP_2	-28≥ΔRSRP>-29	dB
DIFFRSRP_3	-27≥ΔRSRP>-28	dB
DIFFRSRP_4	-26≥ΔRSRP>-27	dB
DIFFRSRP_5	-25≥ΔRSRP>-26	dB
DIFFRSRP_6	-24≥ΔRSRP>-25	dB
DIFFRSRP_7	-23≥ΔRSRP>-24	dB
DIFFRSRP_8	-22≥ΔRSRP>-23	dB
DIFFRSRP_9	-21≥ΔRSRP>-22	dB
DIFFRSRP_10	-20≥ΔRSRP>-21	dB
DIFFRSRP_11	-19≥ΔRSRP>-20	dB
DIFFRSRP_12	-18≥ΔRSRP>-19	dB
DIFFRSRP_13	-17≥ΔRSRP>-18	dB
DIFFRSRP_14	-16≥ΔRSRP>-17	dB
…	…	…
DIFFRSRP_25	-5≥ΔRSRP>-6	dB
DIFFRSRP_26	-4≥ΔRSRP>-5	dB
DIFFRSRP_27	-3≥ΔRSRP>-4	dB
DIFFRSRP_28	-2≥ΔRSRP>-3	dB
DIFFRSRP_29	-1≥ΔRSRP>-2	dB
DIFFRSRP_30	0≥ΔRSRP>-1	dB
DIFFRSRP_31	1≥ΔRSRP>0	dB
DIFFRSRP_32	2≥ΔRSRP>1	dB
DIFFRSRP_33	3≥ΔRSRP>2	dB
DIFFRSRP_34	4≥ΔRSRP>3	dB
DIFFRSRP_35	5≥ΔRSRP>4	dB
DIFFRSRP_36	6≥ΔRSRP>5	dB
…	…	…
DIFFRSRP_47	17≥ΔRSRP>16	dB
DIFFRSRP_48	18≥ΔRSRP>17	dB
DIFFRSRP_49	19≥ΔRSRP>18	dB
DIFFRSRP_50	20≥ΔRSRP>19	dB
DIFFRSRP_51	21≥ΔRSRP>20	dB
DIFFRSRP_52	22≥ΔRSRP>21	dB
DIFFRSRP_53	23≥ΔRSRP>-22	dB
DIFFRSRP_54	24≥ΔRSRP>23	dB
DIFFRSRP_55	25≥ΔRSRP>24	dB
DIFFRSRP_56	26≥ΔRSRP>25	dB
DIFFRSRP_57	27≥ΔRSRP>26	dB
DIFFRSRP_58	28≥ΔRSRP>27	dB
DIFFRSRP_59	29≥ΔRSRP>28	dB
DIFFRSRP_60	30≥ΔRSRP>29	dB
DIFFRSRP_61	ΔRSRP>30	dB

10.1.25 UE Rx-Tx Time Difference Measurements

10.1.25.1 Introduction

The requirements in Clause 10.1.25 shall apply, provided the UE has received *nr-Multi-RTT-RequestLocationInformation* message from LMF via LPP [31] requesting the UE to report one or more UE Rx-Tx time difference measurements defined in TS 38.215 [4].

10.1.25.2 Measurement Accuracy Requirements

10.1.25.3 Report mapping

10.1.25.3.1 Absolute UE Rx-Tx Measurement Report Mapping

The reporting range for the absolute UE Rx-Tx time difference measurement ($T_{UE\ Rx\text{-}Tx}$) is defined from $-985024 \times T_c$ to $985024 \times T_c$ with the resolution step of $2^k \times T_c$, where:

T_c is defined in TS 38.211 [6],

$k_{min} \leq k \leq k_{max}$,

k_{min}=[2] and k_{max}=5, when at least one of the PRS and the SRS resources configured for $T_{UE\ Rx\text{-}Tx}$ is in FR1,

k_{min}=0 and k_{max}=5, when both PRS and SRS resources configured for $T_{UE\ Rx\text{-}Tx}$ are in FR2,

$k \geq$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the RSTD measurement.

The $T_{UE\ Rx\text{-}Tx}$ report mapping for *k* = 0, 1, 2, 3, 4, and 5 are specified in Tables 10.1.25.3.1-1, 10.1.25.3.1-2, 10.1.25.3.1-3, 10.1.25.3.1-4, 10.1.25.3.1-5, and 10.1.25.3.1-6, respectively.

Table 10.1.25.3.1-1: Absolute UE Rx-Tx time difference measurement report mapping for *k*=0

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_0000	$T_{UE\ Rx\text{-}Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{UE\ Rx\text{-}Tx} < -985023$	T_c
RX-TX_TIME_DIFFERENCE_0002	$-985023 \leq T_{UE\ Rx\text{-}Tx} < -985022$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_985024	$-1 \leq T_{UE\ Rx\text{-}Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_985025	$0 \leq T_{UE\ Rx\text{-}Tx} < 1$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_1970047	$985022 \leq T_{UE\ Rx\text{-}Tx} < 985023$	T_c
RX-TX_TIME_DIFFERENCE_1970048	$985023 \leq T_{UE\ Rx\text{-}Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_1970049	$985024 \leq T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.1-2: Absolute UE Rx-Tx time difference measurement report mapping for *k*=1

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_0000	$T_{UE\ Rx\text{-}Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{UE\ Rx\text{-}Tx} < -985022$	T_c
RX-TX_TIME_DIFFERENCE_0002	$-985022 \leq T_{UE\ Rx\text{-}Tx} < -985020$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_492512	$-2 \leq T_{UE\ Rx\text{-}Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_492513	$0 \leq T_{UE\ Rx\text{-}Tx} < 2$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_985023	$985020 \leq T_{UE\ Rx\text{-}Tx} < 985022$	T_c
RX-TX_TIME_DIFFERENCE_985024	$985022 \leq T_{UE\ Rx\text{-}Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_985025	$985024 \leq T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.1-3: Absolute UE Rx-Tx time difference measurement report mapping for *k*=2

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_0000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{UE\ Rx-Tx} < -985020$	T_c
RX-TX_TIME_DIFFERENCE_0002	$-985020 \leq T_{UE\ Rx-Tx} < -985016$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_246256	$-4 \leq T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_246257	$0 \leq T_{UE\ Rx-Tx} < 4$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_492511	$985016 \leq T_{UE\ Rx-Tx} < 985020$	T_c
RX-TX_TIME_DIFFERENCE_492512	$985020 \leq T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_492513	$985024 \leq T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-4: Absolute UE Rx-Tx time difference measurement report mapping for *k*=3

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_0000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{UE\ Rx-Tx} < -985016$	T_c
RX-TX_TIME_DIFFERENCE_0002	$-985016 \leq T_{UE\ Rx-Tx} < -985008$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_123128	$-8 \leq T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_123129	$0 \leq T_{UE\ Rx-Tx} < 8$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_246255	$985008 \leq T_{UE\ Rx-Tx} < 985016$	T_c
RX-TX_TIME_DIFFERENCE_246256	$985016 \leq T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_246257	$985024 \leq T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-5: Absolute UE Rx-Tx time difference measurement report mapping for *k*=4

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_0000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{UE\ Rx-Tx} < -985008$	T_c
RX-TX_TIME_DIFFERENCE_0002	$-985008 \leq T_{UE\ Rx-Tx} < -984992$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_61564	$-16 \leq T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_61565	$0 \leq T_{UE\ Rx-Tx} < 16$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_123127	$984992 \leq T_{UE\ Rx-Tx} < 985008$	T_c
RX-TX_TIME_DIFFERENCE_123128	$985008 \leq T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_123129	$985024 \leq T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.1-6: Absolute UE Rx-Tx time difference measurement report mapping for *k*=5

Reported Quantity Value	Measured Quantity Value	Unit
RX-TX_TIME_DIFFERENCE_0000	$T_{UE\ Rx-Tx} < -985024$	T_c
RX-TX_TIME_DIFFERENCE_0001	$-985024 \leq T_{UE\ Rx-Tx} < -984992$	T_c
RX-TX_TIME_DIFFERENCE_0002	$-984992 \leq T_{UE\ Rx-Tx} < -984960$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_30782	$-32 \leq T_{UE\ Rx-Tx} < 0$	T_c
RX-TX_TIME_DIFFERENCE_30783	$0 \leq T_{UE\ Rx-Tx} < 32$	T_c
…	…	…
RX-TX_TIME_DIFFERENCE_61563	$984960 \leq T_{UE\ Rx-Tx} < 984992$	T_c
RX-TX_TIME_DIFFERENCE_61564	$984992 \leq T_{UE\ Rx-Tx} < 985024$	T_c
RX-TX_TIME_DIFFERENCE_61565	$985024 \leq T_{UE\ Rx-Tx}$	T_c

10.1.25.3.2 Differential UE Rx-Tx Measurement Report Mapping

The reporting range for differential UE Rx-Tx time difference measurement ($\Delta T_{UE\ Rx\text{-}Tx}$) is defined from 0 up to $8191\times T_c$ where:

$\Delta T_{UE\ Rx\text{-}Tx} = T_{UE\ Rx\text{-}Tx1} - T_{UE\ Rx\text{-}Tx2;}$ where:

$T_{UE\ Rx\text{-}Tx1} > T_{UE\ Rx\text{-}Tx2}$,

$T_{UE\ Rx\text{-}Tx1}$ is the first absolute UE Rx-Tx time difference measurement,

$T_{UE\ Rx\text{-}Tx1}$ is the second absolute UE Rx-Tx time difference measurement,

T_c is defined in TS 38.211 [6],

$k_{min} \leq k \leq k_{max}$,

k_{min}=[2] and k_{max}=5, when at least one of the PRS and the SRS resources configured for $\Delta T_{UE\ Rx\text{-}Tx}$ is in FR1,

k_{min}=0 and k_{max}=5, when all the PRS and SRS resources configured for $\Delta T_{UE\ Rx\text{-}Tx}$ are in FR2,

$k \geq$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the RSTD measurement.

The $\Delta T_{UE\ Rx\text{-}Tx}$ report mapping for k = 0, 1, 2, 3, 4, and 5 are specified in Tables 10.1.25.3.2-1, 10.1.25.3.2-2, 10.1.25.3.2-3, 10.1.25.3.2-4, 10.1.25.3.2-5, and 10.1.25.3.2-6, respectively.

Table 10.1.25.3.2-1: Differential UE Rx-Tx time difference measurement report mapping for *k*=0

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \leq \Delta T_{UE\ Rx\text{-}Tx} < 1$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$1 \leq \Delta T_{UE\ Rx\text{-}Tx} < 2$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$2 \leq \Delta T_{UE\ Rx\text{-}Tx} < 3$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_8189	$8189 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8190$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_8190	$8190 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8191$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_8191	$8191 \leq \Delta T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.2-2: Differential UE Rx-Tx time difference measurement report mapping for *k*=1

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \leq \Delta T_{UE\ Rx\text{-}Tx} < 2$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$2 \leq \Delta T_{UE\ Rx\text{-}Tx} < 4$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$4 \leq \Delta T_{UE\ Rx\text{-}Tx} < 6$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_4093	$8186 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8188$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_4094	$8188 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8190$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_4095	$8190 \leq \Delta T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.2-3: Differential UE Rx-Tx time difference measurement report mapping for *k*=2

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \leq \Delta T_{UE\ Rx\text{-}Tx} < 4$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$4 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$8 \leq \Delta T_{UE\ Rx\text{-}Tx} < 12$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_2045	$8180 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8184$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_2046	$8184 \leq \Delta T_{UE\ Rx\text{-}Tx} < 8188$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_2047	$8188 \leq \Delta T_{UE\ Rx\text{-}Tx}$	T_c

Table 10.1.25.3.2-4: Differential UE Rx-Tx time difference measurement report mapping for *k*=3

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \leq \Delta T_{UE\ Rx-Tx} < 8$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$8 \leq \Delta T_{UE\ Rx-Tx} < 16$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$16 \leq \Delta T_{UE\ Rx-Tx} < 24$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_1021	$8168 \leq \Delta T_{UE\ Rx-Tx} < 8176$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_1022	$8176 \leq \Delta T_{UE\ Rx-Tx} < 8184$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_1023	$8184 \leq \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-5: Differential UE Rx-Tx time difference measurement report mapping for *k*=4

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \leq \Delta T_{UE\ Rx-Tx} < 16$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$16 \leq \Delta T_{UE\ Rx-Tx} < 32$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$32 \leq \Delta T_{UE\ Rx-Tx} < 48$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_509	$8144 \leq \Delta T_{UE\ Rx-Tx} < 8160$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_510	$8160 \leq \Delta T_{UE\ Rx-Tx} < 8176$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_511	$8176 \leq \Delta T_{UE\ Rx-Tx}$	T_c

Table 10.1.25.3.2-6: Differential UE Rx-Tx time difference measurement report mapping for *k*=5

Reported Quantity Value	Measured Quantity Value	Unit
DIFF_RX-TX_TIME_DIFFERENCE_0000	$0 \leq \Delta T_{UE\ Rx-Tx} < 32$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0001	$32 \leq \Delta T_{UE\ Rx-Tx} < 64$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_0002	$64 \leq \Delta T_{UE\ Rx-Tx} < 96$	T_c
…	…	…
DIFF_RX-TX_TIME_DIFFERENCE_253	$8096 \leq \Delta T_{UE\ Rx-Tx} < 8128$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_254	$8128 \leq \Delta T_{UE\ Rx-Tx} < 8160$	T_c
DIFF_RX-TX_TIME_DIFFERENCE_255	$8160 \leq \Delta T_{UE\ Rx-Tx}$	T_c

10.1.25.3.3 Additional Path Report Mapping for UE Rx-Tx Time Difference

The reporting range for the additional path reporting for an UE Rx-Tx time difference measurement is defined up to the range from $-8175 \times T_c$ to $8175 \times T_c$ with the resolution step of $2^k \times T_c$, where

T_c is defined in TS 38.211 [6],

$k_{min} \leq k \leq k_{max}$,

k_{min}=[2] and k_{max}=5, when at least one of the PRS resource and SRS resource configured for the UE Rx-Tx time difference measurement is in FR1,

k_{min}=0 and k_{max}=5, when both of the PRS resource and SRS resource configured for the UE Rx-Tx time difference measurement is in FR2,

$k \geq$ *timingReportingGranularityFactor* [34] configured by LMF via LPP for the RSTD measurement.

The UE can report the timing of up to two additional paths with respect to the path timing determining the UE Rx-Tx time difference measurement.

The report mappings for different *k* values are specified in Tables 10.1.25.3.3-1 – 10.1.25.3.3-6.

Table 10.1.25.3.3-1: Report mapping for *k*=0

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_00000	Δpath < -8175	T_c
path_00001	-8175 ≤ Δpath < -8174	T_c
path_00002	-8174 ≤ Δpath < -8173	T_c
…	…	…
path_08175	-1 ≤ Δpath < 0	T_c
path_08176	0 ≤ Δpath < 1	T_c
…	…	…
path_ 16349	8173 ≤ Δpath < 8174	T_c
path_ 16350	8174 ≤ Δpath < 8175	T_c
path_ 16351	8175 ≤ Δpath	T_c

Table 10.1.25.3.3-2: Report mapping for *k*=1

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8175	T_c
path_0001	-8175 ≤ Δpath < -8173	T_c
path_0002	-8173 ≤ Δpath < -8171	T_c
…	…	…
path_4088	-1 ≤ Δpath < 1	T_c
…	…	…
path_8174	8171 ≤ Δpath < 8173	T_c
path_8175	8173 ≤ Δpath < 8175	T_c
path_8176	8175 ≤ Δpath	T_c

Table 10.1.25.3.3-3: Report mapping for *k*=2

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8174	T_c
path_0001	-8174 ≤ Δpath < -8170	T_c
path_0002	-8170 ≤ Δpath < -8166	T_c
…	…	…
path_2044	-2 ≤ Δpath < 2	T_c
…	…	…
path_4086	8166 ≤ Δpath < 8170	T_c
path_4087	8170 ≤ Δpath < 8174	T_c
path_4088	8174 ≤ Δpath	T_c

Table 10.1.25.3.3-4: Report mapping for *k*=3

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8172	T_c
path_0001	-8172 ≤ Δpath < -8164	T_c
path_0002	-8164 ≤ Δpath < -8156	T_c
…	…	…
path_1022	-4 ≤ Δpath < 4	T_c
…	…	…
path_2042	8156 ≤ Δpath < 8164	T_c
path_2043	8164 ≤ Δpath < 8172	T_c
path_2044	8172 ≤ Δpath	T_c

Table 10.1.25.3.3-5: Report mapping for *k*=4

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_0000	Δpath < -8168	T_c
path_0001	-8168 ≤ Δpath < -8152	T_c
path_0002	-8152 ≤ Δpath < -8136	T_c
…	…	…
path_511	-8 ≤ Δpath < 8	T_c
…	…	…
path_1020	8136 ≤ Δpath < 8152	T_c
path_1021	8152 ≤ Δpath < 8168	T_c
path_1022	8168 ≤ Δpath	T_c

Table 10.1.25.3.3-6: Report mapping for *k*=5

Reported Quantity Value, path_i	Measured Quantity Value, Δpath	Unit
path_000	Δpath < -8160	T_c
path_001	-8160 ≤ Δpath < -8128	T_c
path_002	-8128 ≤ Δpath < -8096	T_c
…	…	…
path_256	0 ≤ Δpath < 32	T_c
…	…	…
path_509	8096 ≤ Δpath < 8128	T_c
path_510	8128 ≤ Δpath < 8160	T_c
path_511	8160 ≤ Δpath	T_c

10.1.26 FR2 P-MPR report

The FR2 P-MPR report mapping is defined by this clause.

10.1.26.1 Report mapping

Table 10.1.26.1-1 defines the FR2 P-MPR report mapping.

Table 10.1.26.1-1 Mapping of FR2 P-MPR

Reported value	Measured quantity value	Unit
P-MPR_00	3 ≤ PMP-R < 6	dB
P-MPR_01	6 ≤ PMP-R < 9	dB
P-MPR_02	9 ≤ PMP-R < 12	dB
P-MPR_03	PMP-R ≥ 12	dB

10.2 E-UTRAN measurements

10.2.1 Introduction

Accuracy requirements for measurements on E-UTRAN carrier frequencies are specified in clause 10.2 and apply for UE in SA or NR-DC or NE-DC operation mode.

The requirements in clause 10.2 are applicable for a UE:

- in RRC_CONNECTED state
- performing measurements with appropriate measurement gaps according to clause 9.1.2.
- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 36.300 [24].

The accuracy requirements of E-UTRA measurements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

If the UE needs measurement gaps to perform the inter-RAT NR — E-UTRAN FDD and NR — E-UTRAN TDD measurements, the relevant measurement procedure and measurement gap patterns stated in clause 9.1.2 shall apply.

10.2.2 E-UTRAN RSRP measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRP in RRC_CONNECTED state is specified in clause 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RSRP measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRP Accuracy Requirements in clause 9.1.3 of TS 36.133 [15].

The reporting range and mapping specified for RSRP measurements in clause 9.1.4 of TS 36.133 [15] shall apply.

10.2.3 E-UTRAN RSRQ measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RSRQ in RRC_CONNECTED state is specified in clause 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RSRQ measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ Accuracy Requirements in clause 9.1.6 of TS 36.133 [15].

The requirements for accuracy of E-UTRA RSRQ measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RSRQ Accuracy Requirements in clause 9.1.6 of TS 36.133 [15].

The reporting range and mapping specified for RSRQ measurements in clause 9.1.7 of TS 36.133 [15] shall apply.

10.2.4 E-UTRAN RSTD measurements

The requirements in this clause are valid for UE supporting this capability.

The measurement period is specified in clauses 9.4.4.1 and 9.4.4.2 for inter-RAT NR — E-UTRAN FDD and inter-RAT NR — E-UTRAN TDD RSTD measurements, respectively.

The accuracy requirements and the corresponding side conditions shall be the same as the inter-frequency measurement accuracy requirements for RSTD measurements in RRC_CONNECTED in clause 9.1.10.2 of TS 36.133 [15].

If the UE needs measurement gaps to perform the inter-RAT NR — E-UTRAN FDD and NR — E-UTRAN TDD RSTD measurements, the relevant measurement procedure and measurement gap patterns stated in clause 9.1.2 shall apply.

The reporting range and mapping for the inter-RAT NR — E-UTRAN FDD and NR — E-UTRAN TDD RSTD measurements is the same as specified for RSTD measurements in TS 36.133 [15, clauses 9.1.10.3 and 9.1.10.4].

10.2.5 E-UTRAN RS-SINR measurements

NOTE: This measurement is for handover between NR and E-UTRAN.

The measurement period of E-UTRA RS-SINR in RRC_CONNECTED state is specified in clause 9.4.2 and 9.4.3.

The accuracy requirements of E-UTRA RS-SINR measurements in RRC_CONNECTED state and the corresponding side conditions shall be the same as the inter-frequency RS-SINR Accuracy Requirements in clause 9.1.17.3 of TS 36.133 [15].

The reporting range and mapping for E-UTRA RS-SINR measurements shall be the same as specified for RS-SINR measurements in clause 9.1.17.1 of TS 36.133 [15].

10.3 UTRAN FDD Measurements

The requirements in this clause are applicable for a UE:

- in state RRC_CONNECTED
- performing measurements according to clause 9.4.6 with appropriate measurement gaps
- that is synchronised to the cell that is measured.

The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS 25.302 [30].

The accuracy requirements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled.

10.3.1 UTRAN FDD CPICH RSCP

NOTE: This measurement is for handover between E-UTRAN and UTRAN FDD.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC_CONNECTED state is specified in clause 9.4.6.

In RRC_CONNECTED state the accuracy requirements shall meet the absolute accuracy requirements in table 10.3.1-1, under the following conditions:

- CPICH Ec/Io condition for a detectable cell is as specified in clause 9.4.6;
- SCH_Ec/Io condition for a detectable cell is as specified in clause 9.4.6.

Table 10.3.1-1: UTRAN FDD CPICH_RSCP absolute accuracy

Accuracy		Conditions		
Normal condition	Extreme condition	Io range		
		UTRA operating bands	Minimum Io	Maximum Io
dB	dB		dBm/3.84 MHz	dBm/3.84 MHz
±6	±9	Band I, IV, VI, X XI, XIX and XXI	-94	-70
		Band IX	-93	-70
		Band II, V and VII	-92	-70
		Band III, VIII, XII, XIII, XIV , XX and XXII	-91	-70
		Band XXV, XXVI Note 1	-90.5	-70
±8	±11	Note 2	-70	-50
NOTE 1: For Band XXVI, the condition has the minimum Io of -92 dBm/3.84 MHz when the carrier frequency of the assigned UTRA channel is within 869-894 MHz for the UE which supports both Band V and Band XXVI operating frequencies. NOTE 2: The same bands apply for this requirement as for the corresponding highest accuracy requirement.				

If the UE, in RRC_CONNECTED state, needs measurement gaps to perform UTRAN FDD measurements, the relevant UTRAN FDD measurement procedure and measurement gap pattern stated in clause 9.4.6 shall apply.

The reporting range and mapping specified for FDD CPICH RSCP in TS 25.133 [29] shall apply.

10.3.2 UTRAN FDD CPICH Ec/No

NOTE: This measurement is for handover between E-UTRAN and UTRAN FDD.

The requirements in this clause are valid for terminals supporting this capability.

The measurement period for RRC_CONNECTED state is specified in clause 9.4.6.

In RRC_CONNECTED state the accuracy requirements shall be the same as the inter-frequency measurement accuracy requirements for FDD CPICH Ec/No in TS 25.133 [29].

If the UE, in RRC_CONNECTED state, needs measurement gaps to perform UTRAN FDD measurements, the UTRAN FDD measurement procedure and measurement gap pattern stated in clause 9.4.6 shall apply.

The reporting range and mapping specified for FDD CPICH Ec/No in TS 25.133 [29] shall apply.

11 Void

12 V2X Requirements

12.1 Introduction

This clause contains the requirements for the UE capable of V2X sidelink communication when the UE is out of coverage on the carrier used for V2X sidelink operation, as defined in TS 38.304 [1]. The requirements apply when the UE is:

- in any cell selection state, or,
- configured for V2X SL operation on a V2X carrier which is dedicated to only V2X SL operation and configured with only a PCell on WAN carrier.

Note: Any cell selection state refers to a UE that is out of network coverage and is not associated with a serving cell on any carrier as defined in TS 38.304 [1].

Note: When a UE in RRC_CONNECTED state is performing transmissions and/or reception for V2X sidelink communication, the UE shall meet all the requirements specified in Clause 9 assuming that UE has a dedicated RX/TX chain for V2X sidelink communication. Otherwise, the UE may interrup the V2X sidelink communication in order to meet the measurement requirements specified in Clause 9.

12.2 UE Transmit Timing

12.2.1 Introduction

This clause contains requirements of transmission timing for V2X sidelink communication when:

- GNSS is used as the synchronization reference source;
- NR Cell is used as the synchronization reference source;
- E-UTRAN Cell is used as the synchronization reference source;
- SyncRef UE is used as the synchronization reference source.

12.2.2 GNSS as synchronization reference source

The requirements in this subclause are applicable when the reference timing used by the UE for V2X sidelink communication is derived from GNSS.

The sidelink transmissions takes place $(N_{\mathrm{TA,SL}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ before the subframe starting boundary as defined in TS 38.331 [2], where $N_{\mathrm{TA\ offset}}$ = 0 and $N_{\mathrm{TA,SL}}$ =0.

The transmission timing error for sidelink transmissions shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is defined in Table 12.2.2-1.

Table 12.2.2-1: T_e Timing Error Limit

Frequency Range of sidelink	$T_{e\_}$
FR1	12*64*T_c
Note 1: T_c is the basic timing unit defined in TS 38.211 [6].	

12.2.3 NR Cell as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for sidelink transmissions is a NR serving cell on a non-V2X sidelink carrier.

The sidelink transmissions takes place $(N_{\mathrm{TA,SL}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell, where $N_{\mathrm{TA\ offset}}$ = 0 and $N_{\mathrm{TA,SL}}$ =0.

The transmission timing error for sidelink transmissions shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is defined in Table 12.2.3-1.

Table 12.2.3-1: T_e Timing Error Limit

Frequency Range of sidelink	SCS of SSB signals (kHz)	SCS of sidelink signals (kHz)	T_e
FR1	15	15	14*64*T_c
		30	12*64*T_c
		60	12*64*T_c
	30	15	10*64*T_c
		30	12*64*T_c
		60	9*64*T_c
Note 1: T_c is the basic timing unit defined in TS 38.211 [6].			

12.2.4 E-URTAN Cell as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for sidelink transmissions is an E-UTRAN serving cell on a non-V2X sidelink carrier.

The sidelink transmissions takes place $(N_{\mathrm{TA,SL}} + N_{\mathrm{TA\ offset}}) \times T_{\mathrm{c}}$ before the reception of the first detected path (in time) of the corresponding E-UTRAN downlink frame from the reference cell, where $N_{\mathrm{TA\ offset}}$ = 0 and $N_{\mathrm{TA,SL}}$ =0.

The transmission timing error for sidelink transmissions shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is defined in Table 12.2.4-1.

Table 12.2.4-1: T_e Timing Error Limit

Frequency Range of sidelink	E-UTRAN downlink bandwidth (MHz)	$T_{e\_}$
FR1	≥3	14*64*T_c
Note 1: T_c is the basic timing unit defined in TS 38.211 [6].		

12.2.5 SyncRef UE as synchronization reference source

The requirements in this subclause are applicable when the reference timing used for deriving sidelink transmission is from SyncRef UE transmitting sidelink synchronization signals.

The sidelink transmissions takes place $(N_{\mathrm{TA,SL}} + N_{\mathrm{TA\ offset}}) \times T_c$ before the reception of the first detected path (in time) of the corresponding timing reference frame from the SyncRef UE, where $N_{\mathrm{TA\ offset}}$ = 0 and $N_{\mathrm{TA,SL}}$ =0.

The transmission timing error for sidelink transmissions shall be less than or equal to $\pm T_e$ where the timing error limit value T_e is defined in Table 12.2.5-1.

Table 12.2.5-1: T_e Timing Error Limit

Frequency Range of sidelink	SCS of sidelink signals (kHz)	T_e
FR1	15	12*64*T_c
	30	8*64*T_c
	60	5*64*T_c
Note 1: T_c is the basic timing unit defined in TS 38.211 [6].		

12.3 Initiation/Cease of SLSS Transmissions

12.3.1 Introduction

The requirements in this subclause are applicable to the UE capable of V2X sidelink communication when:

- GNSS is used as the synchronization reference source;
- NR Cell is used as the synchronization reference source;
- EUTRAN Cell is used as the synchronization reference source;
- SyncRef UE is used as the synchronization reference source.

12.3.1.1 Initiation/Cease of SLSS transmissions with NR cell as synchronization reference source

The requirements apply when the NR Cell is used as synchronization reference source and when the UE is

- out of coverage on the V2X NR sidelink carrier and in-coverage with a serving cell on a NR non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in TS 38.331[2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType12*. The UE shall be capable of measuring the RSRP of the cell used as synchronization reference source to evaluate to initiate/cease SLSS transmissions within $T_{\mathrm{evaluate,SLSS}}$

where,

- $T_{\mathrm{evaluate,SLSS}}$ is as specified in Table 12.3.1.1-1 when UE performs SSB based measurements without measurement gaps.
- $T_{\mathrm{evaluate,SLSS}}$ is as specified in Table 12.3.1.1-2 when UE performs SSB based measurements with measurement gaps.

Table 12.3.1.1-1: $T_{evaluate,SLSS}$ for measurements without measurement gaps when NR cell is used as synchronization reference source (FR1)

DRX cycle in NR cell	$T_{evaluate,SLSS}$
No DRX	max(400ms, ceil(2 x 5 x K_p) x SMTC period)[Note 1]
DRX cycle≤ 320ms	max(400ms, ceil(1.5 x 2 x 5 x K_p) x max(SMTC period, DRX cycle))
DRX cycle>320ms	ceil(7 x K_p) x DRX cycle
NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified	

Table 12.3.1.1-2: $T_{evaluate,SLSS}$ for measurements with measurement gaps when NR cell is used as synchronization reference source (FR1)

DRX cycle in NR cell	$T_{evaluate,SLSS}$
No DRX	max(400ms, 2 x 5 x max(MGRP, SMTC period)) x $CSSF_{intra}$
DRX cycle≤ 320ms	max(400ms, ceil(2 x 1.5x 5) x max(MGRP, SMTC period,DRX cycle)) x $CSSF_{intra}$
DRX cycle>320ms	7 x max(MGRP, DRX cycle) x $CSSF_{intra}$

If higher layer filtering is configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the NR cell as synchronization reference source:

- SS-RSRP related side conditions given in clauses 10.1.2 for FR1, respectively, for a corresponding Band,
- SS-RSRQ related side conditions given in clauses 10.1.7 for FR1, respectively, for a corresponding Band,
- SS-SINR related side conditions given in clauses 10.1.12 for FR1, respectively, for a corresponding Band,
- SSB_RP and SSB Ês/Iot according to Annex B.2.2 for a corresponding Band.

12.3.1.2 Initiation/Cease of SLSS transmissions with EUTRAN cell as synchronization reference source

The requirements apply when the EUTRAN Cell is used as synchronization reference source and when the UE is

- out of coverage on the V2X NR sidelink carrier and in-coverage with a serving cell on a LTE non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in TS 36.331[16] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType28*. The UE shall be capable of measuring the RSRP of the cell used as synchronization reference source to evaluate to initiate/cease SLSS transmissions within $T_{evaluate,SLSS}$

where,

- $T_{evaluate,SLSS}$ = 0.4 seconds when UE is not configured with DRX.
- $T_{evaluate,SLSS}$ = as specified in Table 12.3.1.2-1 when UE is configured with DRX.

Table 12.3.1.2-1: $T_{evaluate,SLSS}$ when EUTRAN cell is used as synchronization reference source

DRX cycle length in EUTRAN cell[s]	$T_{evaluate,SLSS}$ [s] (number of DRX cycles)
≤0.04	0.4 (Note 1)
0.04<DRX-cycle≤2.56	Note 2 (6)
Note1: Number of DRX cycles depends upon the DRX cycle in use Note2: Time depends upon the DRX cycles in use	

If higher layer filtering is configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the cell as synchronization reference source:

- RSRP related side conditions given in TS 36.133[15] Clauses 9.1.2.1 and 9.1.2.2 and RSRQ related side conditions given in TS 36.133[15] Clause 9.1.5.1 for a corresponding Band are fulfilled,
- SCH_RP and SCH Ês/Iot according to TS 36.133[15] Annex B.2.1 for a corresponding Band are fulfilled.

12.3.1.3 Initiation/Cease of SLSS transmissions with GNSS as synchronization reference source

The requirements apply when GNSS is used as synchronization reference source and when the UE is

- out of coverage on the V2X sidelink carrier and in-coverage with a serving cell on a non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in TS 38.331[2] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType12* in a NR cell.

When the conditions for SLSS transmissions specified in TS 36.331[16] are met; *networkControlledSyncTx* is not configured; and *syncTxThreshIC* is included in *SystemInformationBlockType28* in a EUTRAN cell.

The requirements in Clause 12.3.1.1 shall apply if the serving cell is a NR cell.

The requirements in Clause 12.3.1.2 shall apply if the serving cell is a EUTRAN cell.

12.3.1.4 Initiation/Cease of SLSS transmissions with SyncRef UE as synchronization reference source

The requirements apply when SyncRef UE is used as synchronization reference source and when the UE is

- in any cell selection state, or
- out of coverage on the V2X sidelink carrier and is associated with a serving cell on a non-V2X sidelink carrier,

and when the conditions for SLSS transmissions specified in TS 38.331[2] are met and when SyncRef UE is used as synchronization reference source and if *syncTxThreshOoC* is included in the preconfigured V2X parameters.

The UE shall be capable of measuring the PSBCH-RSRP of the selected SyncRef UE used as synchronization reference source and evaluate it to initiate/cease SLSS transmissions within $T_{evaluate,SLSS}$ = 4 S-SSB periods.

If higher layer filtering for PSBCH-RSRP measurements is pre-configured, an additional delay in evaluation to initiate/cease SLSS transmissions can be expected.

For the selected SyncRef UE as defined in TS 38.331 [2] used to derive transmission timing for V2X sidelink communication:

- PSBCH-RSRP related side conditions given in Clause 12.4 for a corresponding Band are fulfilled,
- V2X S-SSB_RP and S-SSB Ês/Iot according to Annex B. 4 for a corresponding Band are fulfilled.

12.4 Selection / Reselection of V2X Synchronization Reference Source

The requirements defined in this clause do not apply to the UEs that do not support transmission and reception of SLSS.

A SyncRef UE is considered to be detectable when

- PSBCH-RSRP related side conditions given in Clause 10 are fulfilled for a corresponding Band,
- V2X SCH_RP and SCH Ês/Iot according to Annex B for a corresponding Band are fulfilled.

When GNSS synchronization reference source is configured as the highest priority and

- UE is synchronized to GNSS directly,
  - UE shall not drop any V2X SLSS and data transmission for the purpose of selection/reselection to the SyncRef UE.
- UE is synchronized to a SyncRef UE that is synchronized to GNSS directly or in-directly,
  - UE shall not drop any V2X data transmission for the purpose of selection/reselection to the SyncRef UE. The UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE\_V2X}$ seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331[2]. $T_{detect,SyncRef\ UE\_V2X}$ is defined as 1.6 seconds at SCH Es/Iot $\geq$ 0 dB, provided that the UE is allowed to drop a maximum of 30% of its SLSS transmissions during $T_{detect,SyncRef\ UE\_V2X}$ for the purpose of selection / reselection to the SyncRef UE.
- in other case
  - The UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE\_V2X}$ seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331[2]. $T_{detect,SyncRef\ UE\_V2X}$ is defined as 8 seconds at SCH Es/Iot $\geq$ 0 dB, provided that the UE is allowed to drop a maximum of 6 % of its V2X data and SLSS transmissions during $T_{detect,SyncRef\ UE\_V2X}$ for the purpose of selection / reselection to the SyncRef UE.
  - UE is allowed to drop up to 2 slots of its V2X data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during $T_{detect,SyncRef\ UE\_V2X}$ for the purpose of selection / reselection to the SyncRef UE.

When serving cell/PCell synchronization reference source is configured as the highest priority,

- UE shall be able to identify newly detectable intra-frequency SyncRef UE within $T_{detect,SyncRef\ UE\_V2X}$ seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331[2]. $T_{detect,SyncRef\ UE\_V2X}$ is defined as 8 seconds at SCH Es/Iot $\geq$ 0 dB, provided that the V2X UE is allowed to drop a maximum of 6 % of its V2X data and SLSS transmissions for the purpose of selection / reselection to the SyncRef UE.
- UE is allowed to drop up to 2 slots of its V2X data reception per PSBCH monitoring occasion and overall drop rate shall not exceed 0.3% of its V2X data reception during $T_{detect,SyncRef\ UE\_V2X}$ for the purpose of selection / reselection to the SyncRef UE.

UE shall be capable of performing S-RSRP measurements for [3] identified intra-frequency V2X SyncRef UE with the UE shall be capable of performing PSBCH-RSRP measurements for 3 identified intra-frequency SyncRef UE with the measurement period of 320 ms. It is assumed that the SyncRef UE do not drop or delay any SLSS transmission within the measurement period. Otherwise, the measurement period may be extended.

When UE is synchronized to GNSS directly, before selection / reselection of the new synchronization reference source UE shall evaluate the GNSS synchronization source reliability for at least 20 seconds before changing the synchronization reference from GNSS to another synchronization reference source. UE shall be always synchronized to GNSS directly during the evaluation of GNSS synchronization source reliability.

12.5 L1 SL-RSRP measurements

12.5.1 Introduction

This clause contains the measurement requirements related to resource reselection and resource pre-emption of the UE capable of V2X sidelink communication.

12.5.2 SL-RSRP measurements

The UE physical layer shall be capable of performing the L1 SL-RSRP measurements on the carrier operating V2X sidelink communication for determining the subset of resources to be excluded in PSSCH resource selection in sidelink transmission mode 2. The L1 SL-RSRP measurement period corresponds to one slot and the measurement shall meet the L1 SL-RSRP measurement accuracy requirement in Clause 10. After resource (re-)selection procedure, re-evaluation is performed on the reserved resources by L1 SL-RSRP measurements before transmission of SCI with reservation when the conditions specified in TS 38.214[26] are satisfied.

When the pre-emption mechanism is enabled for the resource pool that UE is monitoring and selecting resource from, after UE selects from the resource not excluded based on L1 SL-RSRP measurement procedure, the UE shall be capable of triggering reselection of already signalled resource(s) as a resource reservation when the conditions specified in TS38.214[26] are satisfied.

12.6 Congestion Control measurements

The UE shall be capable of estimating the channel busy ratio for one or more transmission pools indicated by higher layers in TS 38.331[2], based on SL-RSSI measurements provided by the physical layer.

When no sidelink transmissions occur, the UE physical layer shall perform a single-shot SL-RSSI measurement for each sub-channel included in all the slots configured as transmission pools.

The SL-RSSI measurement performed according to this clause shall meet the SL-RSSI measurement accuracy requirements defined in Clause 10.

The UE shall perform channel busy ratio (CBR) measurement based on SL-RSSI measurements as described in TS 38.215 [4].

12.7 Interruption

12.7.1 Interruptions to WAN due to V2X Sidelink Communication

This clause contains the requirements related to the interruptions on the PCell/serving cell due to V2X sidelink communication.

A UE capable of V2X sidelink communication may indicate its interest (initiation or termination) in V2X sidelink communication to the connected gNodeB using IE *SidelinkUEInformationNR* in TS38.331[2].

The UE is allowed an interruption of up to the duration shown in table 12.7.1-1 on the PCell/serving cell during the RRC reconfiguration procedure that includes the V2X sidelink communication configuration message *SL-ConfigDedicatedNR* in TS 38.331[2] (setup and release). This interruption is for both uplink and downlink of the PCell/serving cell.

Table 12.7.1-1: Interruption length at V2X RRC reconfiguration

μ	NR Slot length (ms)	Interruption length (number of slots)
0	1	2
1	0.5	3
2	0.25	5
3	0.125	9

12.7.2 V2X Sidelink Communication Dropping due to synchronization source change

This clause contains the requirements related to the interruptions on the V2X sidelink communication due to synchronization source change.

For NR V2X UE not supporting gNB/eNB as synchronization reference source, UE is allowed to drop LTE and NR V2X SL transmission or reception for up to 1ms when synchronization source is changed, where the drop of LTE V2X SL transmission or reception applies only to in-device coexistence scenario in TS38.213 [3]:

- From GNSS

    - to syncRef UE that is synchronized to GNSS directly/in-directly
    - to syncRef UE that has the lowest priority
- From syncRef UE that is synchronized to GNSS directly/in-directly
    - to GNSS
    - to syncRef UE that has the lowest priority
- From syncRef UE that has the lowest priority
    - to GNSS
    - to syncRef UE that is synchronized to GNSS directly/in-directly
    - to syncRef UE that has the lowest priority

For NR V2X UE supporting gNB/eNB as synchronization reference source, UE is allowed to drop LTE and NR V2X SL transmission or reception for up to 1ms when synchronization source is changed, where the drop of LTE V2X SL transmission or reception applies only to in-device coexistence scenario in TS38.213 [3]:

- From GNSS
    - to syncRef UE that is synchronized to GNSS directly/in-directly
    - to gNB/eNB
    - to syncRef UE that is synchronized to gNB/eNB directly
    - to syncRef UE that is synchronized to gNB/eNB in-directly
    - to syncRef UE that has the lowest priority
- From syncRef UE that is synchronized to GNSS directly/in-directly
    - to GNSS
    - to gNB/eNB
    - to syncRef UE that is synchronized to gNB/eNB directly
    - to syncRef UE that is synchronized to gNB/eNB in-directly
    - to syncRef UE that has the lowest priority
- From gNB or eNB
    - to GNSS
    - to syncRef UE that is synchronized to GNSS directly/in-directly
    - to eNB or gNB
    - to syncRef UE that is synchronized to gNB or eNB directly
    - to syncRef UE that is synchronized to gNB or eNB in-directly
    - to syncRef UE that has the lowest priority
- From syncRef UE that is synchronized to gNB/eNB directly
    - to GNSS
    - to syncRef UE that is synchronized to GNSS directly/in-directly
    - to gNB/eNB
    - to syncRef UE that is synchronized to gNB/eNB directly

  - to syncRef UE that is synchronized to gNB/eNB in-directly
  - to syncRef UE that has the lowest priority
- From syncRef UE that is synchronized to gNB/eNB in-directly
  - to GNSS
  - to syncRef UE that is synchronized to GNSS directly/in-directly
  - to gNB/eNB
  - to syncRef UE that is synchronized to gNB/eNB directly
  - to syncRef UE that is synchronized to gNB/eNB in-directly
  - to syncRef UE that has the lowest priority
- From syncRef UE that has the lowest priority
  - to GNSS
  - to syncRef UE that is synchronized to GNSS directly
  - to syncRef UE that is synchronized to GNSS in-directly
  - to gNB/eNB
  - to syncRef UE that is synchronized to gNB/eNB directly
  - to syncRef UE that is synchronized to gNB/eNB in-directly
  - to syncRef UE that has the lowest priority

UE is allowed to interruption any V2X sidelink signals including PSSCH, PSCCH, PSBCH, PSFCH and SLSS signals.

12.8 Reliability of GNSS signal

This clause contains requirements regarding reliability of GNSS signal for the UE capable of V2X sidelink communication under the following additional condition:

- The UE is configured or pre-configured with parameters for enabling the UE to acquire the GNSS synchronization.

If UE considers GNSS is a reliable synchronization reference, the UE shall meet timing accuracy requirement as specified in 12.2 and frequency accuracy requirement as specified in 6.4E of TS38.101-1[18]. Otherwise, the UE shall be capable to select another synchronization reference source.

12.9 Scheduling availability

12.9.1 Scheduling availability of UE switching between E-UTRA sidelink and NR sidelink

This clause contains the restrictions on the scheduling availability for V2X sidelink due to switching between E-UTRA V2X sidelink and NR V2X sidelink transmission on a dedicated carrier. For the NR V2X sidelink, the assumed number of configured symbols in a slot is 14.

When switch from E-UTRA V2X sidelink to NR V2X sidelink occurs in NR slot ‘n’,

- UE is not expected to transmit or receive on NR V2X sidelink on the slot ‘n’.

When switch from NR V2X sidelink to E-UTRA V2X sidelink occurs in NR slot ‘n-1’,

- UE is not expected to transmit or receive on NR V2X sidelink on the slot ‘n-1’.

When switch from NR V2X sidelink to E-UTRA V2X sidelink occurs in E-UTRA subframe 'n',

- UE is not expected to transmit or receive on E-UTRA V2X sidelink on the subframe 'n'.

When switch from E-UTRA V2X sidelink to NR V2X sidelink occurs in E-UTRA subframe 'n-1',

- UE is not expected to transmit or receive E-UTRA on V2X sidelink on the subframe 'n-1'.

13 Measurement Performance Requirements for NR gNB

13.1 UL-RTOA

13.1.1 Report mapping

The reporting range of UL Relative Time of Arrival (UL-RTOA), as defined in Clause 5.2.2 of TS 38.215 [4], is defined from -985024T_c to +985024×T_c. The reporting resolution is uniform across the reporting range and is defined as $T = T_c*2^k$ where k is selected by gNB from the set {0, 1, 2, 3, 4, 5}.

T_c is defined in TS 38.211 [6].

LMF provides a recommended resolution parameter, *timingReportingGranularityFactor* [35]. gNB selects parameter k based on *timingReportingGranularityFactor* [35] and informs the LMF.

The mapping of measured quantity for each reporting resolution (k) is defined in Table 13.1.1-1 to Table 13.1.1-6.

Table 13.1.1-1: UL-RTOA measurement report mapping for reporting resolution of T_c (k=0)

Reported Value	Measured Quantity Value	Unit
UL_RTOA_0000	-985024 > UL_RTOA	T_c
UL_RTOA_0001	-985024 ≤ UL_RTOA < -985023	T_c
UL_RTOA_0002	-985023 ≤ UL_RTOA < -985022	T_c
…	…	…
UL_RTOA_985023	-2 ≤ UL_RTOA < -1	T_c
UL_RTOA_985024	-1 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_985025	0 < UL_RTOA ≤ 1	T_c
UL_RTOA_985026	1 < UL_RTOA ≤ 2	T_c
UL_RTOA_985027	2 < UL_RTOA ≤ 3	T_c
…	…	…
UL_RTOA_1970048	985023 < UL_RTOA ≤ 985024	T_c
UL_RTOA_1970049	985024 < UL_RTOA	T_c

Table 13.1.1-2: UL-RTOA measurement report mapping for reporting resolution of $2T_c$ (k=1)

Reported Value	Measured Quantity Value	Unit
UL_RTOA_0000	-985024 > UL_RTOA	T_c
UL_RTOA_0001	-985024 ≤ UL_RTOA < -985022	T_c
UL_RTOA_0002	-985022 ≤ UL_RTOA < -985020	T_c
…	…	…
UL_RTOA_492511	-4 ≤ UL_RTOA < -2	T_c
UL_RTOA_492512	-2 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_492513	0 < UL_RTOA ≤ 2	T_c
UL_RTOA_492514	2 < UL_RTOA ≤ 4	T_c
UL_RTOA_492515	4 < UL_RTOA ≤ 6	T_c
…	…	…
UL_RTOA_985024	985022 < UL_RTOA ≤ 985024	T_c
UL_RTOA_985025	985024 < UL_RTOA	T_c

Table 13.1.1-3: UL-RTOA measurement report mapping for reporting resolution of 4T_c (k=2)

Reported Value	Measured Quantity Value	Unit
UL_RTOA_0000	-985024 > UL_RTOA	T_c
UL_RTOA_0001	-985024 ≤ UL_RTOA < -985020	T_c
UL_RTOA_0002	-985020 ≤ UL_RTOA < -985018	T_c
…	…	…
UL_RTOA_246255	-8 ≤ UL_RTOA < -4	T_c
UL_RTOA_246256	-4 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_246257	0 < UL_RTOA ≤ 4	T_c
UL_RTOA_246258	4 < UL_RTOA ≤ 8	T_c
UL_RTOA_246259	8 < UL_RTOA ≤ 12	T_c
…	…	…
UL_RTOA_492512	985020 < UL_RTOA ≤ 985024	T_c
UL_RTOA_492513	985024 < UL_RTOA	T_c

Table 13.1.1-4: UL-RTOA measurement report mapping for reporting resolution of 8T_c (k=3)

Reported Value	Measured Quantity Value	Unit
UL_RTOA_0000	-985024 > UL_RTOA	T_c
UL_RTOA_0001	-985024 ≤ UL_RTOA < -985016	T_c
UL_RTOA_0002	-985016 ≤ UL_RTOA < -985008	T_c
…	…	…
UL_RTOA_123127	-16 ≤ UL_RTOA < -8	T_c
UL_RTOA_123128	-8 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_123129	0 < UL_RTOA ≤ 8	T_c
UL_RTOA_123130	8 < UL_RTOA ≤ 16	T_c
UL_RTOA_123131	16 < UL_RTOA ≤ 24	T_c
…	…	…
UL_RTOA_246256	985016 < UL_RTOA ≤ 985024	T_c
UL_RTOA_246257	985024 < UL_RTOA	T_c

Table 13.1.1-5: UL-RTOA measurement report mapping for reporting resolution of 16T_c (k=4)

Reported Value	Measured Quantity Value	Unit
UL_RTOA_0000	-985024 > UL_RTOA	T_c
UL_RTOA_0001	-985024 ≤ UL_RTOA < -985008	T_c
UL_RTOA_0002	-985008 ≤ UL_RTOA < -984992	T_c
…	…	…
UL_RTOA_61563	-32 ≤ UL_RTOA < -16	T_c
UL_RTOA_61564	-16 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_61565	0 < UL_RTOA ≤ 16	T_c
UL_RTOA_61566	16 < UL_RTOA ≤ 32	T_c
UL_RTOA_61567	32 < UL_RTOA ≤ 48	T_c
…	…	…
UL_RTOA_123128	985008 < UL_RTOA ≤ 985024	T_c
UL_RTOA_123129	985024 < UL_RTOA	T_c

Table 13.1.1-5: UL-RTOA measurement report mapping for reporting resolution of 32T_c (k=5)

Reported Value	Measured Quantity Value	Unit
UL_RTOA_0000	-985024 > UL_RTOA	T_c
UL_RTOA_0001	-985024 ≤ UL_RTOA < -984992	T_c
UL_RTOA_0002	-984992 ≤ UL_RTOA < -984960	T_c
…	…	…
UL_RTOA_30781	-64 ≤ UL_RTOA < -32	T_c
UL_RTOA_30782	-32 ≤ UL_RTOA ≤ 0	T_c
UL_RTOA_30783	0 < UL_RTOA ≤ 32	T_c
UL_RTOA_30784	32 < UL_RTOA ≤ 64	T_c
UL_RTOA_30785	64 < UL_RTOA ≤ 96	T_c
…	…	…
UL_RTOA_61564	984992 < UL_RTOA ≤ 985024	T_c
UL_RTOA_61565	985024 < UL_RTOA	T_c

13.2 gNB Rx-Tx time difference

13.2.1 Report mapping

The reporting range of gNB Rx-Tx time difference, as defined in Clause 5.2.3 of TS 38.215 [4], is defined from -985024T_c to +985024×T_c. The reporting resolution is uniform across the reporting range and is defined as $T = T_c*2^k$ where k is selected by gNB from the set {0, 1, 2, 3, 4, 5}.

T_c is defined in TS 38.211 [6].

LMF provides a recommended resolution parameter, *timingReportingGranularityFactor* [35]. gNB selects parameter k based on *timingReportingGranularityFactor* [35] and informs the LMF.

The mapping of measured quantity for each reporting resolution (k) is defined in Table 13.2.1-1 to Table 13.2.1-6.

Table 13.2.1-1: gNB Rx-Tx time difference measurement report mapping for reporting resolution of T_c (k=0)

Reported Value	Measured Quantity Value	Unit
RX-TX_0000	-985024 > RX-TX	T_c
RX-TX_0001	-985024 ≤ RX-TX < -985023	T_c
RX-TX_0002	-985023 ≤ RX-TX < -985022	T_c
…	…	…
RX-TX_985023	-2 ≤ RX-TX < -1	T_c
RX-TX_985024	-1 ≤ RX-TX ≤ 0	T_c
RX-TX_985025	0 < RX-TX ≤ 1	T_c
RX-TX_985026	1 < RX-TX ≤ 2	T_c
RX-TX_985027	2 < RX-TX ≤ 3	T_c
…	…	…
RX-TX_1970048	985023 < RX-TX ≤ 985024	T_c
RX-TX_1970049	985024 < RX-TX	T_c

Table 13.2.1-2: gNB Rx-Tx time difference measurement report mapping for reporting resolution of $2T_c$ (k=1)

Reported Value	Measured Quantity Value	Unit
RX-TX_0000	-985024 > RX-TX	T_c
RX-TX_0001	-985024 ≤ RX-TX < -985022	T_c
RX-TX_0002	-985022 ≤ RX-TX < -985020	T_c
…	…	…
RX-TX_492511	-4 ≤ RX-TX < -2	T_c
RX-TX_492512	-2 ≤ RX-TX ≤ 0	T_c
RX-TX_492513	0 < RX-TX ≤ 2	T_c
RX-TX_492514	2 < RX-TX ≤ 4	T_c
RX-TX_492515	4 < RX-TX ≤ 6	T_c
…	…	…
RX-TX_985024	985022 < RX-TX ≤ 985024	T_c
RX-TX_985025	985024 < RX-TX	T_c

Table 13.2.1-3: gNB Rx-Tx time difference measurement report mapping for reporting resolution of $4T_c$ (k=2)

Reported Value	Measured Quantity Value	Unit
RX-TX_0000	-985024 > RX-TX	T_c
RX-TX_0001	-985024 ≤ RX-TX < -985020	T_c
RX-TX_0002	-985020 ≤ RX-TX < -985018	T_c
…	…	…
RX-TX_246255	-8 ≤ RX-TX < -4	T_c
RX-TX_246256	-4 ≤ RX-TX ≤ 0	T_c
RX-TX_246257	0 < RX-TX ≤ 4	T_c
RX-TX_246258	4 < RX-TX ≤ 8	T_c
RX-TX_246259	8 < RX-TX ≤ 12	T_c
…	…	…
RX-TX_492512	985020 < RX-TX ≤ 985024	T_c
RX-TX_492513	985024 < RX-TX	T_c

Table 13.2.1-4: gNB Rx-Tx time difference measurement report mapping for reporting resolution of $8T_c$ (k=3)

Reported Value	Measured Quantity Value	Unit
RX-TX_0000	-985024 > RX-TX	T_c
RX-TX_0001	-985024 ≤ RX-TX < -985016	T_c
RX-TX_0002	-985016 ≤ RX-TX < -985008	T_c
…	…	…
RX-TX_123127	-16 ≤ RX-TX < -8	T_c
RX-TX_123128	-8 ≤ RX-TX ≤ 0	T_c
RX-TX_123129	0 < RX-TX ≤ 8	T_c
RX-TX_123130	8 < RX-TX ≤ 16	T_c
RX-TX_123131	16 < RX-TX ≤ 24	T_c
…	…	…
RX-TX_246256	985016 < RX-TX ≤ 985024	T_c
RX-TX_246257	985024 < RX-TX	T_c

Table 13.2.1-5: gNB Rx-Tx time difference measurement report mapping for reporting resolution of $16T_c$ (k=4)

Reported Value	Measured Quantity Value	Unit
RX-TX_0000	-985024 > RX-TX	T_c
RX-TX_0001	-985024 ≤ RX-TX < -985008	T_c
RX-TX_0002	-985008 ≤ RX-TX < -984992	T_c
…	…	…
RX-TX_61563	-32 ≤ RX-TX < -16	T_c
RX-TX_61564	-16 ≤ RX-TX ≤ 0	T_c
RX-TX_61565	0 < RX-TX ≤ 16	T_c
RX-TX_61566	16 < RX-TX ≤ 32	T_c
RX-TX_61567	32 < RX-TX ≤ 48	T_c
…	…	…
RX-TX_123128	985008 < RX-TX ≤ 985024	T_c
RX-TX_123129	985024 < RX-TX	T_c

Table 13.2.1-5: gNB Rx-Tx time difference measurement report mapping for reporting resolution of $32T_c$ (k=5)

Reported Value	Measured Quantity Value	Unit
RX-TX_0000	-985024 > RX-TX	T_c
RX-TX_0001	-985024 ≤ RX-TX < -984992	T_c
RX-TX_0002	-984992 ≤ RX-TX < -984960	T_c
…	…	…
RX-TX_30781	-64 ≤ RX-TX < -32	T_c
RX-TX_30782	-32 ≤ RX-TX ≤ 0	T_c
RX-TX_30783	0 < RX-TX ≤ 32	T_c
RX-TX_30784	32 < RX-TX ≤ 64	T_c
RX-TX_30785	64 < RX-TX ≤ 96	T_c
…	…	…
RX-TX_61564	984992 < RX-TX ≤ 985024	T_c
RX-TX_61565	985024 < RX-TX	T_c

13.3 UL SRS RSRP measurement

13.3.1 Report mapping

The reporting range of UL SRS RSRP, as defined in clause 5.2.5 of 38.215 [4], is defined from -156dBm to -31dBm with resolution 1dB.

The mapping of measured quantity is defined in Table 13.3.1-1. The range in the signalling may be larger than the guaranteed accuracy range.

Table 13.3.1-1: UL SRS RSRP report mapping

Reported value	Measured quantity value	Unit
SRS_RSRP_0	SRS-RSRP<-156	dBm
SRS_RSRP_1	-156≤SRS-RSRP<-155	dBm
SRS_RSRP_2	-155≤SRS-RSRP<-154	dBm
SRS_RSRP_3	-154≤SRS-RSRP<-153	dBm
SRS_RSRP_4	-153≤SRS-RSRP<-152	dBm
SRS_RSRP_5	-152≤SRS-RSRP<-151	dBm
SRS_RSRP_6	-151≤SRS-RSRP<-150	dBm
SRS_RSRP_7	-150≤SRS-RSRP<-149	dBm
SRS_RSRP_8	-149≤SRS-RSRP<-148	dBm
SRS_RSRP_9	-148≤SRS-RSRP<-147	dBm
SRS_RSRP_10	-147≤SRS-RSRP<-146	dBm
SRS_RSRP_11	-146≤SRS-RSRP<-145	dBm
SRS_RSRP_12	-145≤SRS-RSRP<-144	dBm
SRS_RSRP_13	-144≤SRS-RSRP<-143	dBm
SRS_RSRP_14	-143≤SRS-RSRP<-142	dBm
SRS_RSRP_15	-142≤SRS-RSRP<-141	dBm
SRS_RSRP_16	-141≤SRS-RSRP<-140	dBm
SRS_RSRP_17	-140≤SRS-RSRP<-139	dBm
SRS_RSRP_18	-139≤SRS-RSRP<-138	dBm
…	…	…
SRS_RSRP_111	-46≤SRS-RSRP<-45	dBm
SRS_RSRP_112	-45≤SRS-RSRP<-44	dBm
SRS_RSRP_113	-44≤SRS-RSRP<-43	dBm
SRS_RSRP_114	-43≤SRS-RSRP<-42	dBm
SRS_RSRP_115	-42≤SRS-RSRP<-41	dBm
SRS_RSRP_116	-41≤SRS-RSRP<-40	dBm
SRS_RSRP_117	-40≤SRS-RSRP<-39	dBm
SRS_RSRP_118	-39≤SRS-RSRP<-38	dBm
SRS_RSRP_119	-38≤SRS-RSRP<-37	dBm
SRS_RSRP_120	-37≤SRS-RSRP<-36	dBm
SRS_RSRP_121	-36≤SRS-RSRP<-35	dBm
SRS_RSRP_122	-35≤SRS-RSRP<-34	dBm
SRS_RSRP_123	-34≤SRS-RSRP<-33	dBm
SRS_RSRP_124	-33≤SRS-RSRP<-32	dBm
SRS_RSRP_125	-32≤SRS-RSRP<-31	dBm
SRS_RSRP_126	-31≤SRS-RSRP	dBm

13.4 AoA/ZoA

13.4.1 Report mapping

The reporting range of UL Angle of Arrival, as defined in Clause 5.2.4 of TS 38.215 [4], is defined from -180 degree to +180 degree for azimuth angle (AoA). The reporting resolution is 0.1 degree.

The reporting range of UL Angle of Arrival, as defined in Clause 5.2.4 of TS 38.215 [4], is defined from 0 degree to +180 degree for vertical angle (ZoA). The reporting resolution is 0.1 degree.

The mapping of AoA measured quantity is defined in Table 13.4.1-1. The mapping of ZoA measured quantity is defined in Table 13.4.1-2.

Table 13.4.1-1: AoA measurement report mapping

Reported value	Measured quantity value (SRS-RSRP)	Unit
AoA_0	-180 ⩽ AoA < -179.9	degree
AoA_1	-179.9 ⩽ AoA < -179.8	degree
AoA_2	-179.8 ⩽ AoA < -179.7	degree
…	…	…
AoA_1798	-0.2 ⩽ AoA ⩽ -0.1	degree
AoA_1799	-0.1 ⩽ AoA < 0	degree
AoA_1800	0 ⩽ AoA < 0.1	degree
AoA_1801	0.1 ⩽ AoA < 0.2	degree
AoA_1802	0.2 ⩽ AoA < 0.3	degree
…	…	…
AoA_3598	179.8 ⩽ AoA < 179.9	degree
AoA_3599	179.9 ⩽ AoA < 180	degree

Table 13.4.1-2: ZoA measurement report mapping

Reported value	Measured quantity value (SRS-RSRP)	Unit
ZoA_0	0 ⩽ ZoA < 0.1	degree
ZoA _1	0.1 ⩽ ZoA < 0.2	degree
ZoA _2	0.2 ⩽ ZoA < 0.3	degree
…	…	…
ZoA _1798	179.8 ⩽ ZoA < 179.9	degree
ZoA _1799	179.9 ⩽ ZoA < 180	degree

Annex A (normative): Test Cases

A.1 Purpose of annex

A.2 Requirement classification for statistical testing

Requirements in this specification are either expressed as absolute requirements with a single value stating the requirement, or expressed as a success rate. There are no provisions for the statistical variations that will occur when the parameter is tested.

Annex A outlines the tests in more detail and lists the test parameters needed. The test will result in an outcome of a test variable value for the device under test (DUT) inside or outside the test limit. Overall, the probability of a "good" DUT being inside the test limit(s) and the probability of a "bad" DUT being outside the test limit(s) should be as high as possible. For this reason, when selecting the test variable and the test limit(s), the statistical nature of the test is accounted for.

The statistical nature depends on the type of requirement. Some have large statistical variations, while others are not statistical in nature at all. When testing a parameter with a statistical nature, a confidence level is set. This establishes the probability that a DUT passing the test actually meets the requirements and determines how many times a test has to be repeated and what the pass and fail criteria are. Those aspects are not covered by TS 38.133. The details of the tests on how many times to run it and how to establish confidence in the tests are described in TS 38.533 [5]. This Annex establishes the variable to be used in the test and whether it can be viewed as statistical in nature or not.

A.2.1 Types of requirements in TS 38.133

A.2.1.1 Time and delay requirements on UE higher layer actions

A very large part of the RRM requirements are delay requirements:

- In RRC_IDLE state mobility (clause A.6.1 and A.7.1) there is cell re-selection delay.
- In RRC_CONNECTED state mobility (clauses A.4.3, A.4.6, A.5.3, A.5.6, A.6.3, A.6.6, A.7.3 and A.7.6) there is handover delay, cell search delay and measurement reporting delay.
- In RRC Connection Control (clauses A.4.3.2, A.5.3.2, A.6.3.2 and A.7.3.2) there is RRC re-establishment delay.

All have in common that the UE is required to perform an action observable in higher layers (e.g. camp on the correct cell) within a certain time after a specific event (e.g. when a new strong pilot or reference signal appears). The delay time is statistical in nature for several reasons, among others that several of the measurements are performed by the UE in a fading radio environment.

The variations make a strict limit unsuitable for a test. Instead there is a condition set for a correct action by the UE, e.g. that the UE shall camp on the correct cell within X seconds. Then the rate of correct events is observed during repeated tests and a limit is set on the rate of correct events, usually 90% correct events are required. How the limit is applied in the test depends on the confidence required, further detailed are in TS 38.533 [5].

A.2.1.2 Measurements of power levels, relative powers and time

A very large number of requirements are on measurements that the UE performs:

- In RRC_CONNECTED state mobility (clauses A.4.3, A.5.3, A.6.3 and A.7.3) there are measurement reports.
- In Measurement Performance Requirements (clauses A.4.7, A.5.7, A.6.7 and A.7.7) there are requirements for all type of measurements.

The accuracy requirements on measurements are expressed in this specification as a fixed limit (e.g. +/-X dB), but the measurement error will have a distribution that is not easily confined in fixed limits. Assuming a Gaussian distribution of the error, the limits will have to be set at +/-3.29σ if the probability of failing a "good DUT" in a single test is to be kept at 0.1%. It is more reasonable to set the limit tighter and test the DUT by counting the rate of measurements that are within the limits, in a way similar to the requirements on delay.

A.2.1.3 Implementation requirements

A few requirements are strict actions the UE should take or capabilities the UE should have, without any allowance for deviations. These requirements are absolute and should be tested as such. Examples are:

- "Event triggered report rate" in RRC_CONNECTED state mobility (clauses A.4.3, A.4.6, A.5.3, A.5.6, A.6.3, A.6.6, A.7.3 and A.7.6)
- "Correct behaviour at time-out" in RRC connection control (clauses A.4.3.2, A.5.3.2, A.6.3.2 and A.7.3.2)

A.2.1.4 Physical layer timing requirements

There are requirements on Timing (clauses A.4.4, A.5.4, A.6.4 and A.7.4). There are both absolute and relative limits on timing accuracy depending upon the type of requirement. Examples are:

- Initial Transmit Timing (clauses A.4.4.1, A.5.4.1, A.6.4.1 and A.7.4.1) has an absolute limit on timing accuracy.
- Timing Advance (clauses A.4.4.2, A.5.4.2, A.6.4.2 and A.7.4.2) has a relative limit on timing accuracy.

A.3 RRM test configurations

A.3.1 Reference measurement channels

A.3.1.1 PDSCH

A.3.1.1.1 FDD

Table A.3.1.1.1-1: PDSCH Reference Measurement Channels for SCS=15kHz

Parameter	Unit	Value						
Reference channel		SR.1.1 FDD						
Channel bandwidth	MHz	10						
Number of transmitter antennas		1						
Allocated resource blocks for PDSCH Note 1		24						
Allocated slots per Radio Frame		10						
Radio frame containing SSB	slots	Note 5						
Radio frame not containing SSB	slots	10						
MCS index		4						
Modulation		QPSK						
Target Coding Rate		1/3						
Number of control symbols		2						
PDSCH mapping type		Type A						
Information Bit Payload								
For slots with RMSI Note 2	bits	1608						
For slots without RMSI	bits	1864						
Number of Code Blocks per slot		1						
Binary Channel Bits Per slot								
For slots with RMSI Note 2, Note 4	bits	5184						
For slots without RMSI Note 6	bits	6048						

Note 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
Note 2: PDSCH is scheduled on the slots with RMSI.
Note 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
Note 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 2.
Note 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in clause A.3.10.
Note 6: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.

A.3.1.1.2 TDD

Table A.3.1.1.2-1: PDSCH Reference Measurement Channels for SCS=15kHz

Parameter	Unit	Value						
Reference channel		SR.1.1 TDD						
Channel bandwidth	MHz	10						
Number of transmitter antennas		1						
Allocated resource blocks for PDSCH Note 1		24						
Allocated slots per Radio Frame								
Radio frame containing SSB	slots	Note 5						
Radio frame not containing SSB	slots	4						
MCS table		64QAM						
MCS index		4						
Modulation		QPSK						
Target Coding Rate		1/3						
Number of control symbols		2						
PDSCH mapping type		Type A						
Information Bit Payload								
For slots with RMSI Note 2	bits	1608						
For slots without RMSI	bits	1864						
Number of Code Blocks per slot		1						
Binary Channel Bits Per slot								
For slots with RMSI Note 2, Note 4	bits	5184						
For slots without RMSI Note 6	bits	6048						

Note 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
Note 2: PDSCH is scheduled on the slots with RMSI.
Note 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
Note 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 2.
Note 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in clause A.3.10.
Note 6: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.

Table A.3.1.1.1-2: PDSCH Reference Measurement Channels for SCS=30kHz

Parameter	Unit	Value						
Reference channel		SR.2.1 TDD						
Channel bandwidth	MHz	40						
Number of transmitter antennas		1						
Allocated resource blocks for PDSCH Note 1		24						
Allocated slots per Radio Frame								
Radio frame containing SSB	slots	Note 5						
Radio frame not containing SSB	slots	10						
MCS table		64QAM						
MCS index		4						
Modulation		QPSK						
Target Coding Rate		1/3						
Number of control symbols		2						
PDSCH mapping type		Type A						
Information Bit Payload								
For slots with RMSI Note 2	bits	1608						
For slots without RMSI	bits	1864						
Number of Code Blocks per slot		1						
Binary Channel Bits Per slot								
For slots with RMSI Note 2, Note 4	bits	5184						
For slots without RMSI Note 6	bits	6048						

Note 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block.
Note 2: PDSCH is scheduled on the slots with RMSI.
Note 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
Note 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 2.
Note 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in clause A.3.10.
Note 6: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1..

Table A.3.1.1.1-3: PDSCH Reference Measurement Channels for SCS=120kHz

Parameter	Unit	Value						
Reference channel		SR.3.1 TDD						
Channel bandwidth	MHz	100						
Number of transmitter antennas		1						
Allocated resource blocks for PDSCH Note 1		24						
Allocated slots per Radio Frame								
Radio frame containing SSB	slots	Note 5						
Radio frame not containing SSB	slots	48						
MCS table		64QAM						
MCS index		4						
Modulation		QPSK						
Target Coding Rate		1/3						
Number of control symbols		2						
PDSCH mapping type		Type A						
Information Bit Payload								
For slots with RMSI Note 2	bits	1608						
For slots without RMSI	bits	1864						
Number of Code Blocks per slot		1						
Binary Channel Bits Per slot								
For slots with RMSI Note 2, Note 4	bits	5184						
For slots without RMSI Note 6	bits	6048						

Note 1: Allocated outside the SMTC duration in time and in resource blocks which do not overlap with the resource blocks allocated for SS/PBCH block
Note 2: PDSCH is scheduled on the slots with RMSI.
Note 3: If necessary the information bit payload size can be adjusted to facilitate the test implementation. The payload sizes are defined in TS 38.213 [3].
Note 4: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 2.
Note 5: PDSCH is not scheduled in slots containing SSB according to the SSB configuration used in the test. SSB configurations are defined in clause A.3.10.
Note 6: Derived based on the PDSCH DMRS assumption: dmrs-TypeA-Position=2, dmrs-Type=1, dmrs-AdditonalPositions=2, maxLength=1, Antenna port index: 1000, and Number of PDSCH DMRS CDM group(s) without data: 1.

A.3.1.2 CORESET for RMSI scheduling

A.3.1.2.1 FDD

Table A.3.1.2.1-1: RMSI CORESET Reference Channel for FDD with SCS=15KHz

Parameter	Unit	Value						
Reference channel		CR.1.1 FDD						
Channel bandwidth	MHz	10						
Subcarrier spacing for RMSI CORESET	kHz	15						
Allocated resource blocks for RMSI CORESET Note 7		24						
Subcarrier spacing for SSB	kHz	15						
SSB and RMSI CORESET multiplexing configuration Note 7		Pattern 1						
Offset between SSB and RMSI CORESET Note 3, 7	RB	0 (Note8)						
Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4		Index 4						
Number of transmitter antennas		1						
Duration of RMSI CORESET Note 7	symbols	2						
DCI Format Note 1		Note 2						
Aggregation level	CCE	8						
DMRS precoder granularity		6						
REG bundle size		6						
Mapping from REG to CCE		Distributed						
Cell ID		Note 5						
Payload (without CRC)	bits	Note 6						

Note 1: DCI formats are defined in TS 38.212.
Note 2: DCI format shall depend upon the test configuration.
Note 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest RB index of RMSI CORESET to the smallest RB index of the common RB overlapping with the first RB of the SS/PBCH block.
Note 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in Table 13-11 in TS 38.213 [3].
Note 5: Cell ID shall depend upon the test configuration.
Note 6: Payload size shall depend upon the test configuration.
Note 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in Table 13-1 in TS 38.213 [3]
Note 8: Other values can be used to align with GSCN [13] as long as SSB does not overlap the RMC.

A.3.1.2.2 TDD

Table A.3.1.2.2-1: RMSI CORESET Reference Channel for TDD with SCS=15KHz

Parameter	Unit	Value						
Reference channel		CR.1.1 TDD						
Channel bandwidth	MHz	10						
Subcarrier spacing	kHz	15						
Allocated resource blocks for RMSI CORESET Note 7		24						
SSB and RMSI CORESET multiplexing configuration Note 7		Pattern 1						
Offset between SSB and RMSI CORESET Note 3, 7	RB	0 (Note 8)						
Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4		Index 4						
Number of transmitter antennas		1						
Duration of RMSI CORESET Note 7	symbols	2						
DCI Format Note 1		Note 2						
Aggregation level	CCE	8						
DMRS precoder granularity		6						
REG bundle size		6						
Mapping from REG to CCE		Distributed						
Cell ID		Note 5						
Payload (without CRC)	bits	Note 6						

Note 1: DCI formats are defined in TS 38.212.
Note 2: DCI format shall depend upon the test configuration.
Note 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest RB index of RMSI CORESET to the smallest RB index of the common RB overlapping with the first RB of the SS/PBCH block.
Note 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in Table 13-11 in TS 38.213 [3].
Note 5: Cell ID shall depend upon the test configuration.
Note 6: Payload size shall depend upon the test configuration.
Note 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in Table 13-1 in TS 38.213 [3].
Note 8: Other values can be used to align with GSCN [13] as long as SSB does not overlap the RMC.

Table A.3.1.2.2-2: RMSI CORESET Reference Channel for TDD with SCS=30KHz

Parameter	Unit	Value						
Reference channel		CR.2.1 TDD						
Channel bandwidth	MHz	40						
Subcarrier spacing	kHz	30						
Allocated resource blocks for RMSI CORESET Note 7		24						
SSB and RMSI CORESET multiplexing configuration Note 7		Pattern 1						
Offset between SSB and RMSI CORESET Note 3, 7	RB	0 (Note 8)						
Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4		Index 4						
Number of transmitter antennas		1						
Duration of RMSI CORESET Note 7	symbols	2						
DCI Format Note 1		Note 2						
Aggregation level	CCE	8						
DMRS precoder granularity		6						
REG bundle size		6						
Mapping from REG to CCE		Distributed						
Cell ID		Note 5						
Payload (without CRC)	bits	Note 6						

Note 1: DCI formats are defined in TS 38.212.
Note 2: DCI format shall depend upon the test configuration.
Note 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest RB index of RMSI CORESET to the smallest RB index of the common RB overlapping with the first RB of the SS/PBCH block.
Note 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in Table 13-11 in TS 38.213 [3].
Note 5: Cell ID shall depend upon the test configuration.
Note 6: Payload size shall depend upon the test configuration.
Note 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in Table 13-6 in TS 38.213 [3].
Note 8: Other values can be used to align with GSCN [13] as long as SSB does not overlap the RMC.

Table A.3.1.2.2-3: RMSI CORESET Reference Channel for TDD with SCS=120KHz

Parameter	Unit	Value						
Reference channel		CR.3.1 TDD						
Channel bandwidth	MHz	100						
Subcarrier spacing	kHz	120						
Allocated resource blocks for RMSI CORESET Note 7		24						
SSB and RMSI CORESET multiplexing configuration Note 7		Pattern 1						
Offset between SSB and RMSI CORESET Note 3, 7	RB	0 (Note 8)						
Configuration of PDCCH monitoring occasions for RMSI CORESET Note 4		Index 4						
Number of transmitter antennas		1						
Duration of RMSI CORESET Note 7	symbols	2						
DCI Format Note 1		Note 2						
Aggregation level	CCE	8						
DMRS precoder granularity		6						
REG bundle size		6						
Mapping from REG to CCE		Distributed						
Cell ID		Note 5						
Payload (without CRC)	bits	Note 6						

Note 1: DCI formats are defined in TS 38.212.
Note 2: DCI format shall depend upon the test configuration.
Note 3: The offset is defined with respect to the subcarrier spacing of the CORESET from the smallest RB index of RMSI CORESET to the smallest RB index of the common RB overlapping with the first RB of the SS/PBCH block.
Note 4: The configuration of PDCCH monitoring occasions for RMSI CORESET is defined in Table 13-12 in TS 38.213 [3].
Note 5: Cell ID shall depend upon the test configuration.
Note 6: Payload size shall depend upon the test configuration.
Note 7: The configuration of set of resource blocks and slot symbols of control resource set for Type0-PDCCH search space corresponds to index 0 in Table 13-8 in TS 38.213 [3].
Note 8: Other values can be used to align with GSCN [13] as long as SSB does not overlap the RMC.

A.3.1.3 CORESET for RMC scheduling

A.3.1.3.1 FDD

Table A.3.1.3.1-1: Control Channel RMC for FDD with SCS=15KHz

Parameter	Unit	Value						
Reference channel		CCR.1.1 FDD	CCR.1.2 FDD	CCR.1.3 FDD	CCR.1.4 FDD			
Channel bandwidth	MHz	10	10	10	10			
Subcarrier spacing	kHz	15	15	15	15			
Allocated resource blocks for CORESET Note 3		24	18	24	18			
Number of transmitter antennas		1	1	1	1			
Duration of CORESET	symbols	2	2	2	2			
REG bundle size		6	6	6	6			
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size			
CCE to REG mapping		Interleaved	Interleaved	Interleaved	Interleaved			
Interleave n_shift		0	0	0	0			
Interleave size		2	2	2	2			
Beamforming Pre-Coder		N/A	N/A	N/A	N/A			
Aggregation level	CCE	4	2	8	4			
DCI formats		Note 1	Note 1	Note 1	Note 1			
Payload size (without CRC)	bits	Note 2	Note 2	Note 2	Note 2			
Note 1: DCI format shall depend upon the test configuration. Note 2: Payload size shall depend upon the test configuration Note 3: Allocated in the resource blocks where the associated RMC is scheduled.								

A.3.1.3.2 TDD

Table A.3.1.3.2-1: Control Channel RMC for TDD with SCS=15KHz

Parameter	Unit	Value						
Reference channel		CCR.1.1 TDD	CCR.1.2 TDD	CCR.1.3 TDD	CCR.1.4 TDD			
Channel bandwidth	MHz	10	10	10	10			
Subcarrier spacing	kHz	15	15	15	15			
Allocated resource blocks for CORESET Note 3		24	18	24	18			
Number of transmitter antennas		1	1	1	1			
Duration of CORESET	symbols	2	2	2	2			
REG bundle size		6	6	6	6			
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size			
CCE to REG mapping		Interleaved	Interleaved	Interleaved	Interleaved			
Interleave n_shift		0	0	0	0			
Interleave size		2	2	2	2			
Beamforming Pre-Coder		N/A	N/A	N/A	N/A			
Aggregation level	CCE	4	2	8	4			
DCI formats		Note 1	Note 1	Note 1	Note 1			
Payload size (without CRC)	bits	Note 2	Note 2	Note 2	Note 2			
Note 1: DCI format shall depend upon the test configuration. Note 2: Payload size shall depend upon the test configuration Note 3: Allocated in the resource blocks where the associated RMC is scheduled.								

Table A.3.1.3.2-2: Control Channel RMC for TDD with SCS=30KHz

Parameter	Unit	Value						
Reference channel		CCR.2.1 TDD	CCR.2.2 TDD					
Channel bandwidth	MHz	40	40					
Subcarrier spacing	kHz	30	30					
Allocated resource blocks for CORESET Note 3		24	24					
Number of transmitter antennas		1	1					
Duration of CORESET	symbols	2	2					
REG bundle size		6	6					
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size					
CCE to REG mapping		Interleaved	Interleaved					
Interleave n_shift		0	0					
Interleave size		2	2					
Beamforming Pre-Coder		N/A	N/A					
Aggregation level	CCE	4	8					
DCI formats		Note 1	Note 1					
Payload size (without CRC)	bits	Note 2	Note 2					
Note 1: DCI format shall depend upon the test configuration. Note 2: Payload size shall depend upon the test configuration. Note 3: Allocated in the same resource blocks where the associated RMC is scheduled.								

Table A.3.1.3.2-3: Control Channel RMC for TDD with SCS=120KHz

Parameter	Unit	Value						
Reference channel		CCR.3.1 TDD	CCR.3.2 TDD	CCR.3.3 TDD	CCR.3.4 TDD	CCR.3.5 TDD	CCR.3.6 TDD	
Channel bandwidth	MHz	100	100	100	100	100	100	
Subcarrier spacing	kHz	120	120	120	120	120	120	
Allocated resource blocks for CORESET Note 3		24	24	24	24	24	24	
Number of transmitter antennas		1	1	1	1	1	1	
monitoringSlotPeriodicityAndOffset		sl160 0	sl160 0	sl160 80	sl160 0	sl160 0	sl160 80	
monitoringSymbolsWithinSlot		1100000 0000000	0011000 0000000	1100000 0000000	1100000 0000000	0011000 0000000	1100000 0000000	
Duration of CORESET	slot	1	1	1	1	1	1	
REG bundle size		6	6	6	6	6	6	
DMRS precoder granularity		Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	Same as REG bundle size	
CCE to REG mapping		Interleaved	Interleaved	Interleaved	Interleaved	Interleaved	Interleaved	
Interleave n_shift		0	0	0	0	0	0	
Interleave size		2	2	2	2	2	2	
Beamforming Pre-Coder		N/A	N/A	N/A	N/A	N/A	N/A	
Aggregation level	CCE	4	4	4	8	8	8	
DCI formats		Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	
Payload size (without CRC)	bits	Note 2	Note 2	Note 2	Note 2	Note 2	Note 2	

Note 1: DCI format shall depend upon the test configuration.
Note 2: Payload size shall depend upon the test configuration.
Note 3: Allocated in the same resource blocks where the associated PDSCH RMC is scheduled.

A.3.1.4 TDD UL/DL configuration

Table A.3.1.4-1: TDD UL/DL configuration for SCS=15kHz

Parameter	Unit	Value		
Reference channel		TDDConf.1.1		
referenceSubcarrierSpacing	kHz	15		
TDD UL/DL pattern 1 Note 2		'DSUU' S='10DL:2GP:2UL'		
dl-UL-TransmissionPeriodicity	ms	4		
nrofDownlinkSlots		1		
nrofDownlinkSymbols		10		
nrofUplinkSlot		2		
nrofUplinkSymbols		2		
TDD UL/DL pattern 2 Note 2		'D'		
dl-UL-TransmissionPeriodicity	ms	1		
nrofDownlinkSlots		1		
nrofDownlinkSymbols		0		
nrofUplinkSlot		0		
nrofUplinkSymbols		0		
Note 1: As specified in TS 38.213 [3] and TS 38.331 [2]. Note 2: For information				

Table A.3.1.4-2: TDD UL/DL configuration for SCS=30kHz

Parameter	Unit	Value		
Reference channel		TDDConf.2.1	TDDConf.2.2	
referenceSubcarrierSpacing	kHz	30	30	
TDD UL/DL pattern 1 Note 2		'3D1S4U' S='6DL:4GP:4UL'	'1D1S2U' S='10DL:2GP:2UL'	
dl-UL-TransmissionPeriodicity	ms	4	2	
nrofDownlinkSlots		3	1	
nrofDownlinkSymbols		6	10	
nrofUplinkSlot		4	2	
nrofUplinkSymbols		4	2	
TDD UL/DL pattern 2 Note 2		'DD'	Not configured	
dl-UL-TransmissionPeriodicity	ms	1	Not configured	
nrofDownlinkSlots		2	Not configured	
nrofDownlinkSymbols		0	Not configured	
nrofUplinkSlot		0	Not configured	
nrofUplinkSymbols		0	Not configured	
Note 1: As specified in TS 38.213 [3] and TS 38.331 [2]. Note 2: For information				

Table A.3.1.4-3: TDD UL/DL configuration for SCS=120kHz

Parameter	Unit	Value		
Reference channel		TDDConf.3.1		
referenceSubcarrierSpacing	kHz	120		
TDD UL/DL pattern 1 Note 2		'DDDSU' S='10DL:2GP:2UL'		
dl-UL-TransmissionPeriodicity	ms	0.625		
nrofDownlinkSlots		3		
nrofDownlinkSymbols		10		
nrofUplinkSlot		1		
nrofUplinkSymbols		2		
TDD UL/DL pattern 2 Note 2		Not configured		
dl-UL-TransmissionPeriodicity	ms	Not configured		
nrofDownlinkSlots		Not configured		
nrofDownlinkSymbols		Not configured		
nrofUplinkSlot		Not configured		
nrofUplinkSymbols		Not configured		
Note 1: As specified in TS 38.213 [3] and TS 38.331 [2]. Note 2: For information				

A.3.2 OFDMA channel noise generator (OCNG)

A.3.2.1 Generic OFDMA Channel Noise Generator (OCNG)

The OCNG pattern is used in a test for modelling allocations of unused resources in the channel bandwidth to virtual UEs (which are not under test). The OCNG pattern comprises PDCCH and PDSCH transmissions to the virtual UEs.

A.3.2.1.1 OCNG pattern 1: Generic OCNG pattern for all unused REs

Table A.3.2.1.1-1: OP.1: Generic OCNG pattern for all unused REs

OCNG Parameters	Control Region	Data Region
Resource allocation	Unused REs (Note 1)	Unused REs (Note 2)
Channel	PDCCH	PDSCH
Contents	Virtual UE IDs	Uncorrelated pseudo random QPSK modulated data
Antenna transmission scheme	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Subcarrier spacing	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Aggregation level	Same as used in PDCCH RMC	N/A
Code rate	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Transmit Power	Same as used in PDCCH RMC	Same as used in PDSCH RMC
CP length	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Note 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test. Note 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the channel bandwidth of the cell.		

A.3.2.1.2 OCNG pattern 2: Generic OCNG pattern for all unused REs for 2AoA setup

Table A.3.2.1.2-2: OP.2: Generic OCNG pattern for all unused REs for 2AoA setup

OCNG Parameters	Control Region	Data Region
Probe	Transmitting the serving beam	
Resource allocation	Unused REs (Note 1) in the symbols where SSB/CSI-RS are not transmitted from both the serving beam probe and non-serving beam probe.	Unused REs (Note 2) in the symbols where SSB/CSI-RS are not transmitted from both the serving beam probe and non-serving beam probe.
Channel	PDCCH	PDSCH
Contents	Virtual UE IDs	Uncorrelated pseudo random QPSK modulated data
Antenna transmission scheme	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Subcarrier spacing	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Aggregation level	Same as used in PDCCH RMC	N/A
Code rate	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Transmit Power	Same as used in PDCCH RMC	Same as used in PDSCH RMC
CP length	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Note 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test. Note 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the channel bandwidth of the cell. Note 3: No OCNG is transmitted from the probe transmitting non-serving beam.		

A.3.2.1.3 OCNG pattern 3: Generic OCNG pattern for unused REs in the same bandwidth as PDSCH RMC

Table A.3.2.1.3-1: OP.3: Generic OCNG pattern for unused REs in the same BW as RMC

OCNG Parameters	Control Region	Data Region
Resource allocation	Unused REs (Note 1)	Unused REs (Note 2)
Channel	PDCCH	PDSCH
Contents	Virtual UE IDs	Uncorrelated pseudo random QPSK modulated data
Antenna transmission scheme	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Subcarrier spacing	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Aggregation level	Same as used in PDCCH RMC	N/A
Code rate	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Transmit Power	Same as used in PDCCH RMC	Same as used in PDSCH RMC
CP length	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Note 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test. REs for OCNG shall not be allocated outside the allocated bandwidth of the PDSCH RMC of the serving cell. Note 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the allocated bandwidth of the PDSCH RMC of the serving cell. REs for OCNG shall not be allocated outside the allocated bandwidth of the PDSCH RMC of the serving cell.		

A.3.2.1.4 OCNG pattern 4: Generic OCNG pattern for all unused REs outside SSB slot(s)

Table A.3.2.1.4-1: OP.4: Generic OCNG pattern for all unused REs outside SSB slot(s)

OCNG Parameters	Control Region	Data Region
Resource allocation	Unused REs (Note 1)	Unused REs (Note 2)
Channel	PDCCH	PDSCH
Contents	Virtual UE IDs	Uncorrelated pseudo random QPSK modulated data
Antenna transmission scheme	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Subcarrier spacing	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Aggregation level	Same as used in PDCCH RMC	N/A
Code rate	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Transmit Power	Same as used in PDCCH RMC	Same as used in PDSCH RMC
CP length	Same as used in PDCCH RMC	Same as used in PDSCH RMC
Note 1: REs not used in the active CORESETs where PDCCH is scheduled for the UE under test. REs for OCNG shall not be allocated in the slot(s) containing SSB of the respective cell. Note 2: REs not allocated to any physical channels, CORESET, SSB or any other reference signal within the channel bandwidth of the cell. REs for OCNG shall not be allocated in the slot(s) containing SSB of the respective cell.		

A.3.2.2 Void

A.3.3 Reference DRX configurations

A.3.3.1 DRX Configuration 1: DRX cycle = 40 ms and TAT = 500 ms

Table A.3.3.1-1: DRX.1: DRX cycle = 40 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	1 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	40 ms
shortDRX	disable
TimeAlignmentTimer	500 ms
Note: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.2 DRX Configuration 2: DRX cycle = 640 ms and TAT = 500 ms

Table A.3.3.2-1: DRX.2: DRX cycle = 640 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	1 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	640 ms
shortDRX	disable
TimeAlignmentTimer	500 ms
Note: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.3 DRX Configuration 3: DRX cycle = 40 ms and TAT = Infinity

Table A.3.3.3-1: DRX.3: DRX cycle = 40 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	40 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
Note: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.4 DRX Configuration 4: DRX cycle = 160 ms and TAT = Infinity

Table A.3.3.4-1: DRX.4: DRX cycle = 160 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	psf2
drx-InactivityTimer	psf2
drx-RetransmissionTimer	Psf16
longDRX-CycleStartOffset	sf160, 0
shortDRX	disable
TimeAlignmentTimer	Infinity
Note: This DRX configuration is applicable for E-UTRA serving cell. For further information see clause 6.3.2 in TS 36.331 [16].	

A.3.3.5 DRX Configuration 5: DRX cycle = 320 ms and TAT = Infinity

Table A.3.3.5-1: DRX.5: DRX cycle = 320 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	psf6
drx-InactivityTimer	psf1920
drx-RetransmissionTimer	psf16
longDRX-CycleStartOffset	sf320, 0
shortDRX	disable
TimeAlignmentTimer	Infinity
Note: This DRX configuration is applicable for E-UTRA serving cell. For further information see clause 6.3.2 in TS 36.331 [16].	

A.3.3.6 DRX Configuration 6: DRX cycle = 320 ms and TAT = 500 ms

Table A.3.3.6-1: DRX.6: DRX cycle = 320 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	1 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	320 ms
shortDRX	disable
TimeAlignmentTimer	500 ms
Note: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.7 DRX Configuration 7: DRX cycle = 640 ms and TAT = Infinity

Table A.3.3.7-1: DRX.7: DRX cycle = 640 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	640 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
Note: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.8 DRX Configuration 8: DRX cycle = 320 ms and TAT = Infinity

Table A.3.3.8-1: DRX.8: DRX cycle = 320 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	320 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
Note: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.3.9 DRX Configuration 9: DRX cycle = 40 ms and TAT = 500 ms

Table A.3.3.9-1: DRX.9: DRX cycle = 40 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	psf2
drx-InactivityTimer	psf100
drx-RetransmissionTimer	psf16
longDRX-CycleStartOffset	sf40, 0
shortDRX	disable
TimeAlignmentTimer	500 ms
Note: This DRX configuration is applicable for E-UTRA serving cell. For further information see clause 6.3.2 in TS 36.331 [16].	

A.3.3.10 DRX Configuration 10: DRX cycle = 640 ms

Table A.3.3.10-1: DRX.10: DRX cycle = 640 ms and time alignment timer (TAT) = 500 ms

Field	Value
drx-onDurationTimer	psf6
drx-InactivityTimer	psf1920
drx-RetransmissionTimer	psf16
longDRX-CycleStartOffset	sf640, 0
shortDRX	disable
TimeAlignmentTimer	500 ms
Note: This DRX configuration is applicable for E-UTRA serving cell. For further information see clause 6.3.2 in TS 36.331 [16].	

A.3.3.11 DRX Configuration 11: DRX cycle = 20 ms and TAT = Infinity

Table A.3.3.11-1: DRX.11: DRX cycle = 20 ms and time alignment timer (TAT) = Infinity

Field	Value
drx-onDurationTimer	6 ms
drx-InactivityTimer	1 ms
drx-RetransmissionTimerDL	1 slot
drx-RetransmissionTimerUL	1 slot
drx-LongCycleStartOffset	20 ms
shortDRX	disable
TimeAlignmentTimer	Infinity
Note: This DRX configuration is applicable for NR serving cell. The DRX cycle and time alignment timer parameters are specified in clause 6.3.2 in TS 38.331 [2]	

A.3.4 Test Cases with Different Channel Bandwidths

A.3.4.1 Test Cases with Different E-UTRA Channel Bandwidths

A.3.4.1.1 Introduction

In Annex A test cases involving E-UTRA cell(s) may be defined with different E-UTRA channel bandwidths to verify the same type of RRM requirement.

A.3.4.1.2 Principle of testing

If multiple test cases involving E-UTRA cell(s) are defined with different E-UTRA channel bandwidths to verify the same type of RRM requirement that is E-UTRA channel bandwidth independent, then the UE needs to be tested with only one channel bandwidth in each E-UTRA cell and with the same bandwidth in all the E-UTRA cells used in the test case.

A.3.5 Test Cases for Synchronous and Asynchronous DC Operations

A.3.5.1 EN-DC Test Cases for Synchronous and Asynchronous EN-DC Operations

A.3.5.1.1 Introduction

This clause defines a principle which is applicable to test cases verifying RRM requirements for EN-DC operation in synchronous and asynchronous scenarios.

In Annex A test cases may be defined in both synchronous EN-DC and asynchronous EN-DC scenarios to verify the same type of RRM requirement.

A.3.5.1.2 Principle of Testing

If EN-DC test cases are defined in both synchronous and asynchronous EN-DC scenarios to verify the same type of RRM requirement then the UE capable of both synchronous and asynchronous EN-DC operations needs to be tested with one of the tests in either synchronous or asynchronous EN-DC scenarios.

A.3.6 Antenna configurations

A.3.6.1 Antenna configurations for FR1

Unless otherwise specified, NR FDD or NR TDD cells in all RRM Test cases in AWGN propagation condition are configured with Antenna Configuration 1x2.

A.3.6.1.1 Antenna connection for 4 Rx capable UEs

A.3.6.1.1.1 Introduction

All tests in clause A.4 and A.6 are specified for UEs supporting 2RX. In this clause, the antenna connection method for applying 2RX tests to UEs supporting 4RX antenna ports is specified. No tests are currently specified in clause A.4 or A.6 which are applicable only to 4RX antenna ports, so 4RX capable UEs are always tested by reusing tests which were originally specified for 2RX UEs.

A.3.6.1.1.2 Principle of testing

A.3.6.1.1.2.1 Single carrier tests

For 4RX capable UEs supporting at least one 2RX band, the, all single carrier tests specified in clause A.4 and A.6 except those in A.4.7 and A.6.7 shall be tested on any band where 2RX is supported with the antenna connection specified in A.6.3.1.2.4. For single carrier tests specified in clause A.4.7 or A.6.7, all tests shall be tested with the antenna connection specified in A.3.6.1.1.2.4 for bands where 2RX is supported, and the antenna connection specified in A.3.6.1.1.2.5 for bands where 4RX is supported.

For 4RX capable UEs which do not support any 2RX band, all tests specified in clauses A.4 and A.6 shall be tested using the antenna connection specified in clause A.3.6.1.1.2.5. For radio link monitoring tests, the SNR levels are modified according to table A.3.6.1.1.2.1-1 and table A.3.6.1.1.2.1-2

Table A.3.6.1.1.2.1-1: Modified parameters for RLM out of sync testing with 4 RX antenna connection

Test case	SNR during T3 (dB)			
	Test 1	Test 2	Test 3	Test 4
A.4.5.1.1	-18	N/A	N/A	N/A
A.4.5.1.3	-18	N/A	N/A	N/A
A.4.5.1.5	-18	N/A	N/A	N/A
A.4.5.1.7	-18	N/A	N/A	N/A
A.5.5.1.1	-18	N/A	N/A	N/A
A.5.5.1.3	-18	N/A	N/A	N/A
A.5.5.1.5	-18	N/A	N/A	N/A
A.5.5.1.7	-18	N/A	N/A	N/A
A.6.5.1.1	-18	N/A	N/A	N/A
A.6.5.1.3	-18	N/A	N/A	N/A
A.6.5.1.5	-18	N/A	N/A	N/A
A.6.5.1.7	-18	N/A	N/A	N/A
A.7.5.1.1	-18	N/A	N/A	N/A
A.7.5.1.3	-18	N/A	N/A	N/A
A.7.5.1.5	-18	N/A	N/A	N/A
A.7.5.1.7	-18	N/A	N/A	N/A

Table A.3.6.1.1.2.1-2: Modified parameters for RLM in sync single carrier testing with 4 RX antenna connection

Test case	SNR during T3 (dB)		SNR during T4 (dB)	
	Test 1	Test 2	Test 1	Test 2
A.4.5.1.2	-18	N/A	-8	N/A
A.4.5.1.4	-18	N/A	-8	N/A
A.4.5.1.6	-18	N/A	-8	N/A
A.4.5.1.8	-18	N/A	-8	N/A
A.5.5.1.2	-18	N/A	-8	N/A
A.5.5.1.4	-18	N/A	-8	N/A
A.5.5.1.6	-18	N/A	-8	N/A
A.5.5.1.8	-18	N/A	-8	N/A
A.6.5.1.2	-18	N/A	-8	N/A
A.6.5.1.4	-18	N/A	-8	N/A
A.6.5.1.6	-18	N/A	-8	N/A
A.6.5.1.8	-18	N/A	-8	N/A
A.7.5.1.2	-18	N/A	-8	N/A
A.7.5.1.4	-18	N/A	-8	N/A
A.7.5.1.6	-18	N/A	-8	N/A
A.7.5.1.8	-18	N/A	-8	N/A

Table A.3.6.1.1.2.1-3: Modified parameters for Beam Failure Detection and Link Recovery testing with 4 RX antenna connection

Test case	SNR for RS in set q_0 during T3, T4 and T5 (dB)
	Test 1
A.4.5.5.1	-15
A.4.5.5.2	-15
A.4.5.5.3	-15
A.4.5.5.4	-15
A.5.5.5.1	-15
A.5.5.5.2	-15
A.5.5.5.3	-15
A.5.5.5.4	-15
A.6.5.5.1	-15
A.6.5.5.2	-15
A.6.5.5.3	-15
A.6.5.5.4	-15
A.7.5.5.1	-15
A.7.5.5.2	-15
A.7.5.5.3	-15
A.7.5.5.4	-15

A.3.6.1.1.2.2 Carrier aggregation tests

All carrier aggregation tests are performed using the antenna connection in clause A.3.6.1.1.2.4 for the PCell antenna connection if the PCell is on a band where 2RX is supported or the antenna connection in A.3.6.1.1.2.5 for the PCell antenna connection if the PCell is on a band where 4RX is supported.

All carrier aggregation tests are performed using the antenna connection in clause A.3.6.1.1.2.4 for the SCell antenna connection if an SCell is on band where 2RX is supported or the testing procedure in A.3.6.1.1.2.5 for the SCell antenna connection if an SCell is on a band where 4RX is supported.

A.3.6.1.1.2.3 EN-DC tests

All carrier aggregation tests are performed using the antenna connection in clause A.3.6.1.1.2.6 for the PCell antenna connection if the PCell is on a band where 2RX is supported or the antenna connection in A.3.6.1.1.2.7 for the PCell antenna connection if the PCell is on a band where 4RX is supported.

All carrier aggregation tests are performed using the antenna connection in clause A.3.6.1.1.2.4 for the PSCell or SCell antenna connection if an SCell is on band where 2RX is supported or the testing procedure in A.3.6.1.1.2.5 for the SCell antenna connection if an SCell or PSCell is on a band where 4RX is supported.

A.3.6.1.1.2.4 Antenna connection for bands where 2RX is supported

For bands where 2RX is supported, it is left to the UE declaration and AP configuration to decide which 2 of the 4 Rx ports are connected with data source from system simulator. The remaining 2 Rx ports shall be connected with zero input**.** No test parameters or requirements are modified.

A.3.6.1.1.2.5 Antenna connection for bands where 4RX is supported

For bands where 4RX is supported, all 4 RX antennas are connected with data source from system simulator**.** The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring thresholds described in clauses A.3.6.1.1.2.1 and A.3.6.1.1.2.2, no test parameters or requirements are modified.

A.3.6.1.1.2.6 EN-DC LTE Antenna connection for bands where 2RX is supported

For bands where LTE 2RX is supported, it is left to the UE declaration and AP configuration to decide which 2 of the 4 Rx ports are connected with data source from system simulator. The remaining 2 Rx ports shall be connected with zero input**.** No test parameters or requirements are modified.

A.3.6.1.1.2.7 EN-DC LTE Antenna connection for bands where 4RX is supported

For bands where LTE 4RX is supported, all 4 RX antennas are connected with data source from system simulator**.** The system simulator shall provide independent noise and fading (low correlation) for each antenna port. Except for the modifications to radio link monitoring thresholds described in clauses A.3.8.1.2.1 and A.3.8.1.2.2 of TS 36.133 [15], no test parameters or requirements are modified.

A.3.6.2 Antenna configurations for FR2

Unless otherwise specified, the default Downlink Antenna Configuration for NR FR2 cells is 1x2.

In case of Downlink Antenna Configuration 2x2 for NR FR2 cells, unless otherwise specified, the downlink signal is transmitted over the two polarizations (V and H) of the dual polarized antenna of the test equipment.

In both cases, the downlink signal is received assuming 2 UE baseband receivers. As the UE is tested following the Blackbox Approach with regard to the UE Rx antennas, the exact UE Rx antenna configuration is not relevant for the test configuration and has no impact on the test implementation.

A.3.7 EN-DC test setup

A.3.7.1 Introduction

A.3.7.2 E-UTRAN Serving Cell Parameters

A.3.7.2.1 E-UTRAN Serving Cell Parameters for Tests with NR Cell(s) in FR1

Table A.3.7.2.1-1 defines cell specific test parameters for E-UTRAN cell which can be used in EN-DC test cases or in any test case comprising at least one E-UTRA serving cell with all NR cells in FR1. Unless otherwise stated within the test, all measurements in Annex A.4 and A.5 are performed only on the NR carrier. The E-UTRA serving cell shall configured to not interfere with NR operation and the E-UTRA serving cell signal power shall not be critical to the test purpose.

Table A.3.7.2.1-1: E-UTRAN cell specific test parameters for tests with all NR cells in FR1

Parameter	Unit	E-UTRAN Cell
Duplex mode		FDD or TDD
TDD special subframe configuration[Note1]		6
TDD uplink-downlink configuration[Note1]		1
$BW_{channel}$		5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100
PDSCH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD
OCNG Patterns[Note2]		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD
PBCH_RA	dB	0
PBCH_RB	dB	0
PSS_RA	dB	0
SSS_RA	dB	0
PCFICH_RB	dB	0
PHICH_RA	dB	0
PHICH_RB	dB	0
PDCCH_RA	dB	0
PDCCH_RB	dB	0
PDSCH_RA	dB	0
PDSCH_RB	dB	0
OCNG_RA[Note3]	dB	0
OCNG_RB[Note3]	dB	0
N_{oc}[Note4]	dBm/15 kHz	-104
$\hat{E}_s/N_{oc}$	dB	17
$\hat{E}_s/I_{ot}$	dB	17
RSRP [Note5]	dBm/15 kHz	-87
SCH_RP [Note5]	dBm/15 kHz	-87
Io [Note5]	dBm/Ch BW	-59.13+10log($N_{RB,c}$ /50)
Propagation Condition		AWGN
Antenna Configuration		1x2

Note 1:	Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.
Note 2:	DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 respectively.
Note 3:	OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5:	E_s/I_{ot}, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.3.7.2.2 E-UTRAN Serving Cell Parameters for Tests with NR Cell(s) in FR2

Table A.3.7.2.2-1 defines cell specific test parameters for E-UTRAN cell which can be used in EN-DC test cases or in any test case comprising at least one E-UTRA serving cell with one or more NR cells in FR2.

Table A.3.7.2.2-1: E-UTRAN cell specific test parameters for tests with one or more NR cells in FR2

Parameter	Unit	E-UTRAN Cell
Duplex mode		FDD or TDD
TDD special subframe configuration^Note1		6
TDD uplink-downlink configuration^Note1		1
$BW_{channel}$	MHz	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100
PDSCH parameters: DL Reference Measurement Channel^Note2		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel^Note2		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD
OCNG Patterns^Note2		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD
PBCH_RA	dB	0
PBCH_RB	dB	
PSS_RA	dB	
SSS_RA	dB	
PCFICH_RB	dB	
PHICH_RA	dB	
PHICH_RB	dB	
PDCCH_RA	dB	
PDCCH_RB	dB	
PDSCH_RA	dB	
PDSCH_RB	dB	
OCNG_RA^Note3	dB	
OCNG_RB^Note3	dB	

Note 1:	Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211.
Note 2:	DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 respectively.
Note 3:	OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4:	The E-UTRA signal is required only to ensure the E-UTRA link to the DUT in the EN-DC operation. The Test System shall provide a stable and noise-free E-UTRA signal without need of precise propagation modelling, path loss and polarization control. Further details of the E-UTRA signal configuration are not defined as part of the cell specific test parameters, since the E-UTRA link is not under performance verification and is not expected to influence the NR FR2 requirement.

A.3.7A NR FR1-FR2 test setup

Some Test cases in clause A.7 have NR cells in both FR1 and FR2. Unless otherwise stated within the test, the NR FR1 Cell signal is required only to provide a link to the UE under test. The Test System shall provide a stable and noise-free NR FR1 signal without need of precise propagation modelling, path loss and polarization control. Further details of the NR FR1 signal configuration are not defined as part of the cell specific test parameters, since the NR FR1 link is not under performance verification and is not expected to influence the test purpose.

A.3.8 PRACH configurations

A.3.8.1 Introduction

This clause provides the typical PRACH configurations used for RRM test cases defined in Annex A. To note that for other parameters not listed in this clause, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

A.3.8.2 PRACH configurations in FR1

A.3.8.2.1 FR1 PRACH configuration 1

FR1 PRACH configuration 1 in this clause provides the typical PRACH configuration for SSB-based contention based random access in FR1.

Table A.3.8.2.1-1: Parameters for FR1 PRACH configuration 1

Field	Value	Comment
prach-ConfigurationIndex	102	10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention based preambles per SSB
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
ra-ContentionResolutionTimer	sf48	48 sub-frames
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20ms, as defined in table 7.2-1 in TS 38.321 [7].
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.2.2 FR1 PRACH configuration 2

FR1 PRACH configuration 2 in this clause provides the typical PRACH configuration for SSB based non-contention based random access in FR1.

Table A.3.8.2.2-1: Parameters for FR1 PRACH configuration 2

Field	Value	Comment
prach-ConfigurationIndex	102	10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.2.3 FR1 PRACH configuration 3

FR1 PRACH configuration 3 in this clause provides the typical PRACH configuration for CSI-RS based non-contention based random access in FR1.

Table A.3.8.2.3-1: Parameters for FR1 PRACH configuration 3

Field	Value	Comment
prach-ConfigurationIndex	102	10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20ms, as defined in table 7.2-1 in TS 38.321 [7].
csirs-ResourceList	ra-PreambleIndex = 50	Associated with CSI-RS configured
ra-OccasionList	1	RA occasions allowed corresponding to CSI-RS
rsrp-ThresholdCSI-RS	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.2.4 FR1 PRACH configuration 4

FR1 PRACH configuration 4 in this clause provides the PRACH configuration for CSI-RS based non-contention based random access in FR1 to convey BFR.

Table A.3.8.2.4-1: Parameters for FR1 PRACH configuration 4

Field	Value	Comment
prach-ConfigurationIndex	8	10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n200	Max number of RA preamble transmission performed before declaring a failure is 200
ra-ResponseWindow	sl1	1 slot
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 93
Backoff Parameter Index	2	20ms, as defined in table 7.2-1 in TS 38.321 [7].
BFR-CSIRS-Resource	ra-PreambleIndex = 50	Associated with CSI-RS configured
ra-OccasionList	1	RA occasions allowed corresponding to CSI-RS
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3 PRACH configurations in FR2

A.3.8.3.1 FR2 PRACH configuration 1

FR2 PRACH configuration 1 in this clause provides the typical PRACH configuration for SSB-based contention based random access in FR2.

Table A.3.8.3.1-1: Parameters for FR2 PRACH configuration 1

Field	Value	Comment
prach-ConfigurationIndex	190	Preamble Format C2, with 10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention based preambles per SSB
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
ra-ContentionResolutionTimer	sf48	48 sub-frames
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3.2 FR2 PRACH configuration 2

FR2 PRACH configuration 2 in this clause provides the typical PRACH configuration for SSB based non-contention based random access in FR2.

Table A.3.8.3.2-1: Parameters for FR2 PRACH configuration 2

Field	Value	Comment
prach-ConfigurationIndex	190	Preamble Format C2, with 10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3.3 FR2 PRACH configuration 3

FR2 PRACH configuration 3 in this clause provides the typical PRACH configuration for CSI-RS based non-contention based random access in FR2.

Field	Value	Comment
prach-ConfigurationIndex	190	Preamble Format C2, with 10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random acces
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
ra-ResponseWindow	sl10	10 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
csirs-ResourceList	ra-PreambleIndex = 50	Associated with CSI-RS configured
ra-OccasionList	1	RA occasions allowed corresponding to CSI-RS
rsrp-ThresholdCSI-RS	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.8.3.4 FR2 PRACH configuration 4

FR2 PRACH configuration 4 in this clause provides the PRACH configuration for CSI-RS based non-contention based random access in FR2 to convey BFR.

Field	Value	Comment
prach-ConfigurationIndex	190	Preamble Format C2, with 10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-4 in TS 38.211 [6].
msg1-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
prach-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msg1-FDM	One	One PRACH transmission occasions FDMed in one time instance.
powerRampingStep	dB2	
preambleReceivedTargetPower	dBm-120	
preambleTransMax	n200	Max number of RA preamble transmission performed before declaring a failure is 200.
ra-ResponseWindow	sl40	40 slots
zeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
BFR-CSIRS-Resource	ra-PreambleIndex = 50	Associated with CSI-RS configured
ra-OccasionList	1	RA occasions allowed corresponding to CSI-RS
rsrp-ThresholdSSB	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.9 BWP configurations

A.3.9.1 Introduction

This clause provides the typical BWP configurations used for RRM test cases defined in Annex A. For downlink BWP, both initial BWP and dedicated BWP configurations are specified in clause A.3.9.2 and for uplink BWP, both initial BWP and dedicated BWP configurations are specified in clause A.3.9.3. To note that for other parameters not listed in this clause, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

A.3.9.2 Downlink BWP configurations

A.3.9.2.1 Initial BWP

Table A.3.9.2.1-1: Downlink BWP patterns for initial BWP configuration

BWP Parameters	Unit	Values		
Reference BWP		DLBWP.0.1	DLBWP.0.2	
Starting PRB index		0	RB_a Note 1	
Bandwidth	RB	Same as RF channel defined in each test	same as RMSI CORESET (CORESET #0) defined in each test	
Note 1: RB_a is the lowest PRB index to guarantee the BWP including SSB PRB index (RB_J, RB_{J+1},…., RB_{J+19}) which is defined in Clause A.3.10.				

A.3.9.2.2 Dedicated BWP

Table A.3.9.2.2-1: Downlink BWP patterns for dedicated BWP configuration

BWP Parameters	Unit	Values		
Reference BWP		DLBWP.1.1	DLBWP.1.2	DLBWP.1.3
Starting PRB index		0	RB_b Note 1	RB_a Note 2
Bandwidth	RB	Same as RF channel defined in each test	25 for SCS = 15KHz, 51 for SCS = 30KHz, 32 for SCS = 120KHz	25 for SCS = 15KHz, 51 for SCS = 30KHz, 32 for SCS = 120KHz
Note 1: RB_b is the lowest PRB index to guarantee the BWP not fully overlapped with SSB PRB index (RB_J, RB_{J+1},…., RB_{J+19}) which is defined in Clause A.3.10. Note 2: RB_a is the lowest PRB index to guarantee the BWP including SSB PRB index (RB_J, RB_{J+1},…., RB_{J+19}) which is defined in Clause A.3.10.				

A.3.9.3 Uplink BWP configurations

A.3.9.3.1 Initial BWP

Table A.3.9.3.1-1: Uplink BWP patterns for initial BWP configuration

BWP Parameters	Unit	Values		
Reference BWP		ULBWP.0.1	ULBWP.0.2	
Starting PRB index		0	RB_a Note 1	
Bandwidth	RB	Same as RF channel defined in each test	same as RMSI CORESET (CORESET #0) defined in each test	
Note 1: RB_a is same as RB_a for DLBWP.0.2 as defined in Table A.3.9.2.1-1.				

A.3.9.3.2 Dedicated BWP

Table A.3.9.3.2-1: Uplink BWP patterns for dedicated BWP configuration

BWP Parameters	Unit	Values		
Reference BWP		ULBWP.1.1	ULBWP.1.2	ULBWP.1.3
Starting PRB index		0	RB_b Note 1	RB_a Note 2
Bandwidth	RB	Same as RF channel defined in each test	25 for SCS = 15KHz, 51 for SCS = 30KHz, 32 for SCS = 120KHz	25 for SCS = 15KHz, 51 for SCS = 30KHz, 32 for SCS = 120KHz
Note 1: RB_b is same as RB_b for DLBWP.1.2 as defined in Table A.3.9.2.2-1. Note 2: RB_a is same as RB_a for DLBWP.1.3 as defined in Table A.3.9.2.2-1.				

A.3.10 SSB Configurations

A.3.10.1 SSB Configurations for FR1

A.3.10.1.1 SSB pattern 1 in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

Table A.3.10.1.1-1: SSB.1 FR1: SSB Pattern 1 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values
Channel bandwidth	10 MHz
SSB SCS	15 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 2	2-5
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0
RB numbers containing SSB within channel BW	(RB_J, RB_{J+1},…., RB_{J+19}) Note 1
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.1.2 SSB pattern 2 in FR1: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10.1.2-1: SSB.2 FR1: SSB Pattern 2 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values
Channel bandwidth	40 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2
Slot numbers containing SSB Note 3	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0
RB numbers containing SSB within channel BW	(RB_J, RB_{J+1},…., RB_{J+19})Note 1
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by Table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. Note 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves	

A.3.10.1.3 SSB pattern 3 in FR1: SSB allocation for SSB SCS=15 kHz in 10 MHz

Table A.3.10.1.3-1: SSB.3 FR1: SSB Pattern 3 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values	
Channel bandwidth	10 MHz	
SSB SCS	15 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSB Note 2	2-5	8-11
Slot numbers containing SSB Note 2	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0	
RB numbers containing SSB within channel BW	(RB_J, RB_{J+1},…., RB_{J+19})Note 1	
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.1.4 SSB pattern 4 in FR1: SSB allocation for SSB SCS=30 kHz in 40 MHz

Table A.3.10.1.4-1: SSB.4 FR1: SSB Pattern 4 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values	
Channel bandwidth	40 MHz	
SSB SCS	30 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2	8-11
Slot numbers containing SSB Note 3	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0	
RB numbers containing SSB within channel BW	(RB_J, RB_{J+1},…., RB_{J+19})Note 1	
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by Table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. Note 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.1.5 SSB pattern 5 in FR1: SSB allocation for SSB SCS=15 kHz starting from odd SFN in 10 MHz

Table A.3.10.1.5-1: SSB.5 FR1: SSB Pattern 5 for SSB SCS=15 kHz in 10 MHz channel

SSB Parameters	Values
Channel bandwidth	10 MHz
SSB SCS	15 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 2	2-5
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 1
RB numbers containing SSB within channel BW	(RB_J, RB_{J+1},…., RB_{J+19})Note 1
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.1.6 SSB pattern 6 in FR1: SSB allocation for SSB SCS=30 kHz starting from odd SFN in 40 MHz

Table A.3.10.1.6-1: SSB.6 FR1: SSB Pattern 6 for SSB SCS=30 kHz in 40 MHz channel

SSB Parameters	Values
Channel bandwidth	40 MHz
SSB SCS	30 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSB Note 3	4-7 or 2-5 Note 2
Slot numbers containing SSB Note 3	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 1
RB numbers containing SSB within channel BW	(RB_J, RB_{J+1},…., RB_{J+19})Note 1
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: Symbols 4-7 is chosen, if the SSB pattern Case B should be used for the current band as indicated by Table 5.4.3.3-1 of TS 38.104 [13]; Otherwise, symbol 2-5 is chosen. Note 3: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2 SSB Configurations for FR2

A.3.10.2.1 SSB pattern 1 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.1-1: SSB.1 FR2: SSB Pattern 1 for SSB SCS = 120 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	120 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSBs Note 2	4-7	8-11
Slot numbers containing SSB Note 2	0	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0	
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+19})Note 1	
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.2 SSB pattern 2 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.2-1: SSB.2 FR2: SSB Pattern 2 for SSB SCS = 240 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	240 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	0	1
Symbol numbers containing SSBs Note 2	8-11	12-13, 0-1
Slot numbers containing SSB Note 2	0	0, 1
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0	
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+39}) Note 1	
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.3 SSB pattern 3 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.3-1: SSB.3 FR2: SSB Pattern 3 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	4-7
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+19}) Note 1
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.4 SSB pattern 4 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.4-1: SSB.4 FR2: SSB Pattern 4 for SSB SCS = 240 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	240 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	0
Symbol numbers containing SSBs Note 2	8-11
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+39}) Note 1
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.5 SSB pattern 5 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.5-1: SSB.5 FR2: SSB Pattern 5 for SSB SCS = 120 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	120 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3
Symbol numbers containing SSBs Note 2	2-5	6-9
Slot numbers containing SSB Note 2	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0	
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+19}) Note 1	
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.6 SSB pattern 6 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.6-1: SSB.6 FR2: SSB Pattern 6 for SSB SCS = 240 kHz in 100 MHz channel with 2 SSBs per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	240 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	2	
SS/PBCH block index	2	3
Symbol numbers containing SSBs Note 2	2-5	6-9
Slot numbers containing SSB Note 2	1	1
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0	
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+39}) Note 1	
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.10.2.7 SSB pattern 7 in FR2: SSB allocation for SSB SCS=120 kHz in 100 MHz

Table A.3.10.2.7-1: SSB.7 FR2: SSB Pattern 7 for SSB SCS = 120 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values
Channel bandwidth	100 MHz
SSB SCS	120 kHz
SSB periodicity (T_{SSB})	20 ms
Number of SSBs per SS-burst	1
SS/PBCH block index	1
Symbol numbers containing SSBs Note 2	8-11
Slot numbers containing SSB Note 2	0
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+19}) Note 1
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.	

A.3.10.2.8 SSB pattern 8 in FR2: SSB allocation for SSB SCS=240 kHz in 100 MHz

Table A.3.10.2.8-1: SSB.8 FR2: SSB Pattern 8 for SSB SCS = 240 kHz in 100 MHz channel with 1 SSB per SS-burst

SSB Parameters	Values	
Channel bandwidth	100 MHz	
SSB SCS	240 kHz	
SSB periodicity (T_{SSB})	20 ms	
Number of SSBs per SS-burst	1	
SS/PBCH block index	1	
Symbol numbers containing SSBs Note 2	12-13	0-1
Slot numbers containing SSB Note 2	0	1
SFN containing SSB	SFN mod (max(T_{SSB},10ms)/10ms) = 0	
RB numbers containing SSBs within channel BW	(RB_J, RB_{J+1},…., RB_{J+39})Note 1	
Note 1: RBs containing SSB can be configured in any frequency location within the cell bandwidth according to the allowed synchronization raster defined in TS 38.104 [13]. Note 2: These values have been derived from other parameters for information purposes (as per TS 38.213 [3]). They are not settable parameters themselves.		

A.3.11 SMTC Configurations

A.3.11.1 SMTC pattern 1: SMTC period = 20 ms with SMTC duration = 1 ms

Table A.3.11.1-1: SMTC.1: SMTC Pattern 1 for SMTC period = 20 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	0 ms
SMTC duration	1 ms

A.3.11.2 SMTC pattern 2: SMTC period = 20 ms with SMTC duration = 5 ms

Table A.3.11.2-1: SMTC.2: SMTC Pattern 2 for SMTC period = 20 ms and duration = 5 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	0 ms
SMTC duration	5 ms

A.3.11.3 SMTC pattern 3: SMTC period = 160 ms with SMTC duration = 1 ms

Table A.3.11.3-1: SMTC.3: SMTC Pattern 3 for SMTC period = 20 ms and duration = 5 ms

SMTC Parameters	Values
SMTC periodicity	160 ms
SMTC offset	0 ms
SMTC duration	1 ms

A.3.11.4 SMTC pattern 4: SMTC period = 20 ms with SMTC duration = 1 ms

Table A.3.11.4-1: SMTC.4: SMTC Pattern 4 for SMTC period = 20 ms and duration = 1 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	10 ms
SMTC duration	1 ms

A.3.11.5 SMTC pattern 5: SMTC period = 20 ms with SMTC duration = 5 ms

Table A.3.11.4-1: SMTC.5: SMTC Pattern 5 for SMTC period = 20 ms and duration = 5 ms

SMTC Parameters	Values
SMTC periodicity	20 ms
SMTC offset	10 ms
SMTC duration	5 ms

A.3.12 Test Cases with Different CC Configurations

A.3.12.1 EN-DC Test Cases with Different EN-DC Configurations

A.3.12.1.1 Introduction

In Annex A EN-DC test cases may be defined for two component carriers (CCs) as well as for more than two CCs to verify the same RRM requirement.

A.3.12.1.2 Principle of testing

If multiple EN-DC test cases are defined for two CCs as well as for more than two CCs to verify the same type of RRM requirement, which depends on the number of CCs, then from the UE performance point of view the test coverage can be considered fulfilled by executing only the EN-DC test cases with the maximum number of CCs in EN-DC supported by the UE. Otherwise if the same type of RRM requirement is independent of the number of CCs then from the UE performance point of view the test coverage can be considered fulfilled by executing only the EN-DC test cases with two CCs in EN-DC supported by the UE.

Editor's: The maximum number of CCs that can be used in FR2 tests in EN-DC would depend on the test equipment capability.

A.3.12.2 Carrier Aggregation Test Cases with Different CA Configurations

A.3.12.2.1 Introduction

In Annex A carrier aggregation test cases may be defined for two CCs as well as for more than two CCs to verify the same RRM requirement.

A.3.12.2.2 Principle of testing

If multiple carrier aggregation test cases are defined for two CCs as well as for more than two CCs to verify the same RRM requirement, which depends on the number of CCs, then from the UE performance point of view the test coverage can be considered fulfilled by executing only the CA test cases with the maximum number of CCs in CA supported by the UE. Otherwise if the same type of RRM requirement is independent of the number of CCs then from the UE performance point of view the test coverage can be considered fulfilled by executing only the CA test cases with at least two CCs in CA supported by the UE.

Editor's: The maximum number of CCs that can be used in FR2 tests in CA would depend on the test equipment capability.

A.3.13 Test Cases in SA and EN-DC Operations

A.3.13.1 Introduction

This clause defines a principle which is applicable to test cases verifying RRM requirements in standalone (SA) or EN-DC operations.

In Annex A test cases may be defined in SA and EN-DC operations to verify the same RRM requirement.

Editor's note: this clause may need to define further for NE-DC and NR-DC test cases, which subjects to the test cases defined in the future.

A.3.13.2 Principle of Testing

If test cases are defined in both SA and EN-DC operations to verify the same RRM requirement then the UE capable of both SA and EN-DC operations needs to verify that RRM requirement by performing test case(s) in either SA operation or in EN-DC operation.

If test cases are defined in both SA and EN-DC operations to verify at least one common RRM requirement then the UE capable of both SA and EN-DC operations needs to verify RRM requirements by performing test case(s) in either SA operation or in EN-DC operation provided that the performed test case(s):

- verifies the largest number of RRM requirements and
- verifies at least all RRM requirements covered in the test case(s), which is not performed.

A.3.14 CSI-RS configurations

A.3.14.1 FDD

Table A.3.14.1-1: CSI-RS Reference Measurement Channels for SCS=15kHz

	CSI-RS.1.1 FDD	**CSI-RS.1.2 FDD**	**CSI-RS.1.3 FDD**	**CSI-RS.1.4 FDD**	**CSI-RS.1.5 FDD**
Resource Type	**periodic**	**periodic**	**aperiodic**	**aperiodic**	**aperiodic**
Resource Set Config					
nzp-CSI-ResourceSetId	0	0	0	0	0
repetition	n.a.	off	off	on	off
aperiodicTriggeringOffset	n.a.	n.a.	6	6	6
trs-Info	n.a.	n.a.	n.a.	n.a.	n.a.

<table>
<tr><th>Resource Config</th><th></th><th></th><th></th><th></th><th></th></tr>
<tr><td rowspan="8">nzp-CSI-RS-ResourceId</td><td rowspan="8">0 for resource #0</td><td rowspan="4">10 for resource #0</td><td rowspan="4">20 for resource #0</td><td>0 for resource #0</td><td rowspan="4">0 for resource #0</td></tr>
<tr><td>1 for resource #1</td></tr>
<tr><td>2 for resource #2</td></tr>
<tr><td>3 for resource #3</td></tr>
<tr><td rowspan="4">11 for resource #1</td><td rowspan="4">21 for resource #1</td><td>4 for resource #4</td><td rowspan="4">1 for resource #1</td></tr>
<tr><td>5 for resource #5</td></tr>
<tr><td>6 for resource #6</td></tr>
<tr><td>7 for resource #7</td></tr>
<tr><td>powerControlOffset</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>powerControlOffsetSS</td><td>db0</td><td>db0</td><td>db0</td><td>db0</td><td>db0</td></tr>
<tr><td>scramblingID</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Period (slots)</td><td>slot5</td><td>slot10</td><td>n.a.</td><td>n.a.</td><td>n.a.</td></tr>
<tr><td>Offset</td><td>1</td><td>1</td><td>n.a.</td><td>n.a.</td><td>n.a.</td></tr>
<tr><td rowspan="2">qcl-InfoPeriodicCSI-RS</td><td rowspan="2">TCI.State.0</td><td>TCI.State.0</td><td rowspan="2">n.a.</td><td rowspan="2">n.a.</td><td rowspan="2">n.a.</td></tr>
<tr><td>TCI.State.1</td></tr>
<tr><td>frequencyDomainAllocation</td><td>000001</td><td>0001</td><td>0001</td><td>0001</td><td>000001</td></tr>
<tr><td>nrofPorts</td><td>2</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td rowspan="8">firstOFDMSymbolInTimeDomain</td><td rowspan="8">5 for resource #0</td><td rowspan="4">6 for resource #0</td><td rowspan="4">6 for resource #0</td><td>0 for resource #0</td><td rowspan="4">Specified in the test case for resource #0</td></tr>
<tr><td>1 for resource #1</td></tr>
<tr><td>2 for resource #2</td></tr>
<tr><td>3 for resource #3</td></tr>
<tr><td rowspan="4">10 for resource #1</td><td rowspan="4">10 for resource #1</td><td>4 for resource #4</td><td rowspan="4">n.a.</td></tr>
<tr><td>5 for resource #5</td></tr>
<tr><td>6 for resource #6</td></tr>
<tr><td>7 for resource #7</td></tr>
<tr><td>cdm-Type</td><td>FD-CDM2</td><td>noCDM</td><td>noCDM</td><td>noCDM</td><td>noCDM</td></tr>
<tr><td>density</td><td>1</td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>startingRB</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>nrofRBs</td><td>276 (Note 1)</td><td>276 (Note 1)</td><td>276 (Note 1)</td><td>276 (Note 1)</td><td>276 (Note 1)</td></tr>
<tr><td colspan="6">Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.</td></tr>
</table>

A.3.14.2 TDD

Table A.3.14.2-1: CSI-RS Reference Measurement Channels for SCS=15kHz

	CSI-RS.1.1 TDD	**CSI-RS.1.2 TDD**	**CSI-RS.1.3 TDD**	**CSI-RS.1.4 TDD**
Resource Type	periodic	periodic	aperiodic	aperiodic
Resource Set Config				
nzp-CSI-ResourceSetId	0	0	0	0
repetition	n.a.	off	off	on
aperiodicTriggeringOffset	n.a.	n.a.	6	6
trs-Info	n.a.	n.a.	n.a.	n.a.
Resource Config				
nzp-CSI-RS-ResourceId	0 for resource #0	10 for resource #0	20 for resource #0	0 for resource #0
				1 for resource #1
				2 for resource #2
				3 for resource #3
		11 for resource #1	21 for resource #1	4 for resource #4
				5 for resource #5
				6 for resource #6
				7 for resource #7
powerControlOffset	0	0	0	0
powerControlOffsetSS	db0	db0	db0	db0
scramblingID	0	0	0	0
Period (slots)	slot5	slot10	n.a.	n.a.
Offset	1	1	n.a.	n.a.
qcl-InfoPeriodicCSI-RS	TCI.State.0	TCI.State.0	n.a.	n.a.
		TCI.State.1		
frequencyDomainAllocation	000001	0001	0001	0001
nrofPorts	2	1	1	1
firstOFDMSymbolInTimeDomain	5 for resource #0	6 for resource #0	6 for resource #0	0 for resource #0
				1 for resource #1
				2 for resource #2
				3 for resource #3
		10 for resource #1	10 for resource #1	4 for resource #4
				5 for resource #5
				6 for resource #6
				7 for resource #7
cdm-Type	FD-CDM2	noCDM	noCDM	noCDM
density	1	3	3	3
startingRB	0	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)
Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.				

Table A.3.14.2-2: CSI-RS Reference Measurement Channels for SCS=30kHz

Resource Type	CSI-RS.2.1 TDD periodic	CSI-RS.2.2 TDD periodic	CSI-RS.2.3 TDD aperiodic	CSI-RS.2.4 TDD aperiodic	CSI-RS.2.5 TDD aperiodic
Resource Set Config					
nzp-CSI-ResourceSetId	0	0	0	0	0
repetition	n.a.	off	off	on	off
aperiodicTriggeringOffset	n.a.	n.a.	6	6	6
trs-Info	n.a.	n.a.	n.a.	n.a.	n.a.
Resource Config					
nzp-CSI-RS-ResourceId	0 for resource #0	10 for resource #0 11 for resource #1	20 for resource #0 21 for resource #1	0 for resource #0 1 for resource #1 2 for resource #2 3 for resource #3 4 for resource #4 5 for resource #5 6 for resource #6 7 for resource #7	0 for resource #0 1 for resource #1
powerControlOffset	0	0	0	0	0
powerControlOffsetSS	db0	db0	db0	db0	db0
scramblingID	0	0	0	0	0
Period (slots)	slot10	slot20	n.a.	n.a.	n.a.
Offset	2	2	n.a.	n.a.	n.a.
qcl-InfoPeriodicCSI-RS	TCI.State.0	TCI.State.0 TCI.State.1	n.a.	n.a.	n.a.
frequencyDomainAllocation	000001	0001	0001	0001	000001
nrofPorts	2	1	1	1	1
firstOFDMSymbolInTimeDomain	5 for resource #0	6 for resource #0 10 for resource #1	6 for resource #0 10 for resource #1	0 for resource #0 1 for resource #1 2 for resource #2 3 for resource #3 4 for resource #4 5 for resource #5 6 for resource #6 7 for resource #7	Specified in the test case for resource #0 n.a.
cdm-Type	FD-CDM2	noCDM	noCDM	noCDM	noCDM
density	1	3	3	3	3
startingRB	0	0	0	0	0
nrofRBs	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)	276 (Note 1)
Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.					

Table A.3.14.2-3: CSI-RS Reference Measurement Channels for SCS=120kHz

<table>
<tr><th></th><th>CSI-RS.3.1 TDD</th><th>CSI-RS.3.2 TDD</th><th>CSI-RS.3.3 TDD</th><th>CSI-RS.3.4 TDD</th></tr>
<tr><td>Resource Type</td><td>periodic</td><td>periodic</td><td>aperiodic</td><td>aperiodic</td></tr>
<tr><td>Resource Set Config</td><td></td><td></td><td></td><td></td></tr>
<tr><td>nzp-CSI-ResourceSetId</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>repetition</td><td>n.a.</td><td>off</td><td>off</td><td>on</td></tr>
<tr><td>aperiodicTriggeringOffset</td><td>n.a.</td><td>n.a.</td><td>6</td><td>6</td></tr>
<tr><td>trs-Info</td><td>n.a.</td><td>n.a.</td><td>n.a.</td><td>n.a.</td></tr>
<tr><td>Resource Config</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="8">nzp-CSI-RS-ResourceId</td><td rowspan="8">0 for resource #0</td><td rowspan="4">10 for resource #0</td><td rowspan="4">20 for resource #0</td><td>0 for resource #0</td></tr>
<tr><td>1 for resource #1</td></tr>
<tr><td>2 for resource #2</td></tr>
<tr><td>3 for resource #3</td></tr>
<tr><td rowspan="4">11 for resource #1</td><td rowspan="4">21 for resource #1</td><td>4 for resource #4</td></tr>
<tr><td>5 for resource #5</td></tr>
<tr><td>6 for resource #6</td></tr>
<tr><td>7 for resource #7</td></tr>
<tr><td>powerControlOffset</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>powerControlOffsetSS</td><td>db0</td><td>db0</td><td>db0</td><td>db0</td></tr>
<tr><td>scramblingID</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Period (slots)</td><td>slot40</td><td>slot80</td><td>n.a.</td><td>n.a.</td></tr>
<tr><td>Offset</td><td>8</td><td>8</td><td>n.a.</td><td>n.a.</td></tr>
<tr><td rowspan="2">qcl-InfoPeriodicCSI-RS</td><td rowspan="2">TCI.State.0</td><td>TCI.State.0</td><td rowspan="2">n.a.</td><td rowspan="2">n.a.</td></tr>
<tr><td>TCI.State.1</td></tr>
<tr><td>frequencyDomainAllocation</td><td>000001</td><td>0001</td><td>0001</td><td>0001</td></tr>
<tr><td>nrofPorts</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td rowspan="8">firstOFDMSymbolInTimeDomain</td><td rowspan="8">5 for resource #0</td><td rowspan="4">6 for resource #0</td><td rowspan="4">6 for resource #0</td><td>0 for resource #0</td></tr>
<tr><td>1 for resource #1</td></tr>
<tr><td>2 for resource #2</td></tr>
<tr><td>3 for resource #3</td></tr>
<tr><td rowspan="4">10 for resource #1</td><td rowspan="4">10 for resource #1</td><td>4 for resource #4</td></tr>
<tr><td>5 for resource #5</td></tr>
<tr><td>6 for resource #6</td></tr>
<tr><td>7 for resource #7</td></tr>
<tr><td>cdm-Type</td><td>FD-CDM2</td><td>noCDM</td><td>noCDM</td><td>noCDM</td></tr>
<tr><td>density</td><td>1</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>startingRB</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>nrofRBs</td><td>276 (Note 1)</td><td>276 (Note 1)</td><td>276 (Note 1)</td><td>276 (Note 1)</td></tr>
<tr><td colspan="5">Note 1: If the configured value of PRBs is larger than the width of the corresponding BWP relevant for the test case, the Test Equipment shall implement CSI-RS only in the width of that BWP.</td></tr>
</table>

A.3.15 Angle of Arrival (AoA) for FR2 RRM test cases

This clause specifies the AoA setups for FR2 RRM test cases in clause A.5 and A.7. The applicable AoA setup is defined in each test case in clause A.5 and A.7.

A.3.15.1 Setup 1: Single AoA in Rx beam peak direction

There is only one active probe in the test. The DL signals, and noise if applicable, transmitted from the probe, are aligned to the UE Rx beam peak direction (as defined in TS 38.101-2 [19]).

A.3.15.2 Setup 2: Single AoA in non Rx beam peak direction

A.3.15.2.1 Setup 2a: Single AoA in non Rx beam peak direction without change in direction

There is only one active probe in the test. The DL signals, and noise if applicable, transmitted from the probe, align to a direction (AoA) which is from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class. The direction (AoA) of the signals shall not be changed between test iterations.

A.3.15.2.2 Setup 2b: Single AoA in non Rx beam peak direction with change in direction

There is only one active probe in the test. The DL signals, and noise if applicable, transmitted from the probe, align to a direction (AoA) which is from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class. For UE power class 3, the direction (AoA) of the signals shall be changed for each test iteration (for UE power classes other than 3, this is FFS).

A.3.15.3 Setup 3: 2 AoAs

There are 2 active probes in the test. The DL signals, and noise if applicable, transmitted from the two active probes, align to directions (AoAs) which are from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class. The relative angular offset between the directions (AoAs) of the 2 active probes, shall be changed for each test iteration. The applicable set of relative angular offsets between the 2 active probes is given in Table 3.15.3-1 for each UE power class.

Editor Note: If RAN5 finds the changing of angular offset between the directions (AoAs) of the 2 active probes per test iteration to be infeasible from the perspectives of EIS spherical coverage and other impacts, e.g.: testing time, then the test setup will be revised.

Table 3.15.3-1: Set of relative angular offsets between active probes for each power class

UE Power class	Relative angular offset between active probes
1	FFS
2	FFS
3	30°, 60°, 90°, 120° and 150°
4	FFS

A.3.15.4 Setup 4: 2 AoAs, 1 AoA in Rx beam peak direction, 1 in non Rx beam peak

A.3.15.4.1 Setup 4a: 2 AoAs, 1 AoA in Rx beam peak direction, 1 in non Rx beam peak without change in direction

There are 2 active probes in the test. The DL signals, and noise if applicable, are transmitted from the two active probes. One probe is aligned to the UE Rx beam peak direction as defined in TS 38.101-2 [19]. The second is aligned to a direction (AoA) which is from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class. The direction (AoA) of the non Rx beam peak signal shall not be changed between test iterations.

A.3.15.4.2 Setup 4b: 2 AoAs, 1 AoA in Rx beam peak direction, 1 in non Rx beam peak with change in direction

There are 2 active probes in the test. The DL signals, and noise if applicable, are transmitted from the two active probes. One probe is aligned to the UE Rx beam peak direction as defined in TS 38.101-2 [19]. The second is aligned to a direction (AoA) which is from the set of directions corresponding to the EIS spherical coverage percentile of the DUT as defined in clause 7.3.4 of TS 38.101-2 [19] for each UE power class.

For UE power class 3, the relative angular offset between the directions (AoAs) of the 2 active probes shall be changed for each test iteration, within the probe alignment described above. The applicable set of relative angular offsets between the 2 active probes is given in Table 3.15.3-1 for each UE power class.

A.3.16 TCI State Configuration

A.3.16.1 Introduction

This clause provides the configurations for TCI states towards either SSB or CSI-RS. The TCI states defined in this clause are configured in each test when applicable to indicate that certain DL signals are QCL'ed with the referenceSignal configured in the TCI states.

A.3.16.2 TCI states

Table A.3.16.2-1: TCI States

Parameter	TCI.State.0	TCI.State.1	TCI.State.2	TCI.State.3
tci-StateId	Id0	Id1	Id2	Id3
qcl-Type1	typeC	typeC	typeA	typeA
qcl-Type2 Note1	typeD	typeD	typeD	typeD
referenceSignal	SSB0	SSB1	Resource #4 in TRS resource set 1 Note3	Resource #4 in TRS resource set 2 Note3
Note 1: qcl-Type2 of typeD only where applicable. For RRM test cases, this will be only in FR2 Note 2: referenceSignal configurations towards which the TCI states are configured are defined in a test-specific manner. Note 3: Reference TRS resource sets are defined in A.3.17, and the applicable TRS resource set(s) are specified in each test case. When a single TRS resource set is configured in a test case, it is considered as resource set 1.				

Table A.3.16.2-2: Void

A.3.17 Configurations of CSI-RS for tracking

A.3.17.1 Configuration of CSI-RS for tracking for FR1

A.3.17.1.1 FDD

Table A.3.17.1.1-1: CSI-RS for tracking for SCS=15kHz

Parameter	Unit	Value
Reference channel		TRS.1.1 FDD
Bandwidth		BW of Active BWP[Note 1]
SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	20 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	-3[Note 2]
TCI state		TCI.State.0
Note 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases Note 2: Unless otherwise specified in the test case		

Table A.3.17.1.1-2: CSI-RS for tracking for SCS=30kHz

Parameter	Unit	Value
Reference channel		TRS.1.2 FDD
Bandwidth		BW of Active BWP[Note 1]
SCS	kHz	30
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	40 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	-3[Note 2]
TCI state		TCI.State.0
Note 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases Note 2: Unless otherwise specified in the test case		

A.3.17.1.2 TDD

Table A.3.17.1.2-1: CSI-RS for tracking for SCS=15kHz

Parameter	Unit	Value
Reference channel		TRS.1.1 TDD
Bandwidth		BW of Active BWP[Note 1]
SCS	kHz	15
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	20 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	-3[Note 2]
TCI state		TCI.State.0
Note: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases		

Table A.3.17.1.2-2: CSI-RS for tracking for SCS=30kHz

Parameter	Unit	Value
Reference channel		TRS.1.2 TDD
Bandwidth		BW of Active BWP[Note 1]
SCS	kHz	30
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 5 for CSI-RS resource 1 and 3 l_0 = 9 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	40 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	20 for CSI-RS resource 1 and 2 21 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	-3[Note 2]
TCI state		TCI.State.0
Note 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases Note 2: Unless otherwise specified in the test case		

A.3.17.2 Configuration of CSI-RS for tracking for FR2

A.3.17.2.1 TDD

Table A.3.17.2.1-1: CSI-RS for tracking for SCS=120kHz Set 1

Parameter	Unit	Value
Reference channel		TRS.2.1 TDD
Bandwidth		BW of Active BWP Note 1,3
SCS	kHz	120
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 1 for CSI-RS resource 1 and 3 l_0 = 5 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	80 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	-3 Note 2
TCI state		TCI.State.0
Note 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases Note 2: Unless otherwise specified in the test case Note 3: If active BWP is larger than 52RBs, BW of TRS is configured as 52RBs. Otherwise, same as active BWP size.		

Table A.3.17.2.1-2: CSI-RS for tracking for SCS=120kHz Set 2

Parameter	Unit	Value
Reference channel		TRS.2.2 TDD
Bandwidth		BW of Active BWP Note 1,3
SCS	kHz	120
First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
First OFDM symbol in the slot used for CSI-RS		l_0 = 2 for CSI-RS resource 1 and 3 l_0 = 6 for CSI-RS resource 2 and 4
Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
Density (ρ)		3 for CSI-RS resource 1,2,3,4
CSI-RS periodicity	slots	80 for CSI-RS resource 1,2,3,4
CSI-RS offset	slots	40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4
EPRE ratio to SSS	dB	-3 Note 2
TCI state		TCI.State.1
Note 1: BW of TRS is configured same as the BW size of UE active BWP in the RRM test cases Note 2: Unless otherwise specified in the test case Note 3: If active BWP is larger than 52RBs, BW of TRS is configured as 52RBs. Otherwise, same as active BWP size.		

A.3.18 Additional definitions related to OTA testing for FR2 RRM test cases

A.3.18.1 Introduction

FR2 RRM test cases are performed over the air (OTA). This clause provides additional definitions and clarifications on the OTA measurements and metrics defined or refered in the test cases.

A.3.18.2 PRACH Power Measurement

PRACH power is measured as EIRP(Link=Link angle, Meas=Link angle) as defined in clause 3.1 of TS 38.101-2 [19].

A.3.19 Test applicability for DAPS handover

A.3.19.1 Introduction

In Annex A test cases for DAPS handover may be defined with cells in on same or different carrier frequency to verify intra-frequency, intra-band inter-frequency and inter-band inter-frequency DAPS handover RRM requirements, respectively.

A.3.19.2 Principle of testing

To verify intra-frequency DAPS handover requirements

- The UE capable of intra-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.
- The UE not capable of intra-frequency asynchronous DAPS handover on any band but capable of synchronous DAPS handover on some band needs to be tested only in synchronous scenario.

To verify intra-band inter-frequency DAPS handover requirements

- The UE capable of intra-band inter-frequency asynchronous DAPS handover on any band needs to be tested only in asynchronous scenario.
- The UE not capable of intra-band inter-frequency asynchronous DAPS handover on any band but capable of intra-band inter-frequency synchronous DAPS handover on some band needs to be tested only in synchronous scenario.

To verify inter-band inter-frequency DAPS handover requirements

- The UE capable of inter-band inter-frequency asynchronous DAPS handover on any band combination needs to be tested only in asynchronous scenario.
- The UE not capable of inter-band inter-frequency asynchronous DAPS handover on any band combination but capable of inter-band inter-frequency synchronous DAPS handover on some band combination needs to be tested only in synchronous scenario.

A.3.20 MsgA configurations

A.3.20.1 Introduction

This clause provides the typical PRACH and PUSCH configurations for MsgA used for RRM test cases defined in Annex A. To note that for other parameters not listed in this clause, either it can be derived from the set up of each test or it is subjected to RAN5 specifications.

A.3.20.2 MsgA configurations in FR1

A.3.20.2.1 FR1 MsgA configuration 1

FR1 MsgA configuration 1 in this clause provides the typical MsgA configuration for SSB-based contention based random access for 2-step RA type in FR1.

Table A.3.20.2.1-1: Parameters for FR1 MsgA configuration 1

Field	Value	Comment
msgA-prach-ConfigurationIndex	102	10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
msgA-totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
msgA-SSB-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention based preambles per SSB
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
ra-ContentionResolutionTimer	sf48	48 sub-frames
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
msgB-ResponseWindow	sl10	10 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20ms, as defined in table 7.2-1 in TS 38.321 [7].
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	14	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of RBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	1	Configure 1 port per CDM group
msgA-DeltaPreamble	3	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1
deltaMCS	Disabled	Whether to apply delta MCS
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.20.2.2 FR1 MsgA configuration 2

FR1 PRACH configuration 2 in this clause provides the typical MsgA configuration for SSB based non-contention based random access for 2-step RA type in FR1.

Table A.3.20.2.2-1: Parameters for FR1 MsgA configuration 2

Field	Value	Comment
msgA-prach-ConfigurationIndex	102	10ms PRACH periodicity, and other detailed configuration defined in table 6.3.3.2-2 and table 6.3.3.2-3 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
msgA-totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
msgB-ResponseWindow	sl10	10 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	14	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of RBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	1	Configure 1 port per CDM group
msgA-DeltaPreamble	3	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1
deltaMCS	Disabled	Whether to apply delta MCS
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.20.3 MsgA configurations in FR2

A.3.20.3.1 FR2 MsgA configuration 1

FR2 MsgA configuration 1 in this clause provides the typical MsgA configuration for SSB-based contention based random access for 2-step RA type in FR2.

Table A.3.20.3.1-1: Parameters for FR2 MsgA configuration 1

Field	Value	Comment
msgA-prach-ConfigurationIndex	190	Preamble Format C2, with 10ms PRACH periodicity, and other detailed configurations defined in table 6.3.3.2-4 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
msgA-totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
msgA-SSB-perRACH-OccasionAndCB-PreamblesPerSSB	oneFourth, n48	OneFourth: 1 SSB associated with 4 RACH occasions n48: 48 contention-based preambles per SSB
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
ra-ContentionResolutionTimer	sf48	48 sub-frames
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
msgB-ResponseWindow	sl10	10 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	10	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of RBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	1	Configure 1 port per CDM group
msgA-DeltaPreamble	3	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1
deltaMCS	Disabled	Whether to apply delta MCS
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.3.20.3.2 FR2 MsgA configuration 2

FR2 MsgA configuration 2 in this clause provides the typical MsgA configuration for SSB based non-contention based random access for 2-step RA type in FR2.

Table A.3.20.3.2-1: Parameters for FR2 MsgA configuration 2

Field	Value	Comment
msgA-prach-ConfigurationIndex	190	Preamble Format C2, with 10ms PRACH periodicity, and other detailed configurations defined in table 6.3.3.2-4 in TS 38.211 [6].
msgA-SubcarrierSpacing	Same as UL carrier SCS	
totalNumberOfRA-Preambles	48	Total number of preambles used for contention based and contention free random access
numberOfRA-PreamblesGroupA	48	No group B.
msgA-PRACH-RootSequenceIndex	0	Logic sequence index = 0, resulting in root sequence = 1.
ssb-perRACH-Occasion	oneFourth	OneFourth: 1 SSB associated with 4 RACH occasions
msgA-RO-FDM	One	One PRACH transmission occasions FDMed in one time instance.
msgA-PreamblePowerRampingStep	dB2	
msgA-PreambleReceivedTargetPower	dBm-120	
preambleTransMax	n6	Max number of RA preamble transmission performed before declaring a failure is 6
msgB-ResponseWindow	sl10	10 slots
msgA-ZeroCorrelationZoneConfig	11	N-CS configuration, N_{CS} = 23
Backoff Parameter Index	2	20 ms, as defined in table 7.2-1 in TS 38.321 [7].
ssb-ResourceList	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE doesn't use this field if is transmitting CFRA to convey BFR.
BFR-SSB-Resource	ra-PreambleIndex = 50	Associated with SSB index 0. UE doesn't use ssb-ResourceList and BFR-SSB-Resource IEs at the same time. UE uses this field only if is transmitting CFRA to convey BFR
ra-ssb-OccasionMaskIndex	1	PRACH occasion index 1 is allowed
msgA-MCS	1	MCS index for MsgA PUSCH
nrofSlotsMsgA-PUSCH	1	Number of slots containing one or multiple PUSCH occasions
nrofMsgA-PO-PerSlot	1	Number of time domain PUSCH occasions in each slot
msgA-PUSCH-TimeDomainOffset	1	A single time offset with respect to the start of each PRACH slot, counted as the number of slots
PUSCH start symbol	0	
PUSCH allocation length	10	
mappingTypeMsgA-PUSCH	typeA	
nrofPRBs-PerMsgA-PO	2	Number of RBs per PUSCH occasion
nrofMsgA-PO-FDM	One	The number of MsgA PUSCH occasions FDMed in one time instance
msgA-DMRS-AdditionalPosition	pos1	Position for additional DM-RS
msgA-PUSCH-NrofPorts	1	Configure 1 port per CDM group
msgA-DeltaPreamble	3	Power offset of msgA PUSCH relative to the preamble received target power
msgA-Alpha	alpha1	Alpha value for MsgA PUSCH. Set 1
deltaMCS	Disabled	Whether to apply delta MCS
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.4 EN-DC tests with all NR cells in FR1

A.4.1 Void

A.4.2 Void

A.4.3 RRC_CONNECTED state mobility

A.4.3.1 Void

A.4.3.2 RRC Connection Mobility Control

A.4.3.2.1 Void

A.4.3.2.2 Random Access

A.4.3.2.2.1 4-step RA type contention based random access test in FR1 for PSCell in EN-DC

A.4.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in Table A.4.3.2.2.1.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in Table A.4.3.2.2.1.1-2.

Table A.4.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR1 for PSCell in EN-DC

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.4.3.2.2.1.1-2: General test parameters for contention based random access test in FR1 for PSCell in EN-DC

Parameter			Unit	Test-1	Comments
SSB Configuration	Config 1,2			SSB pattern 3 in FR1	As defined in A.3.10
	Config 3,4			SSB pattern 4 in FR1	
Duplex Mode for Cell 2	Config 1,2			FDD	
	Config 3,4			TDD	
TDD Configuration	Config 3,4			TDDConf.2.1	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 4	Config 1,2			SR.1.1 FDD	As defined in A.3.1.1.
	Config 3,4			SR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	3	Power of SSB with index 0 is setto be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s/N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s/N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2	Config 1,2		dBm	-65.3/9.36MHz	For symbols without SSB index 1
	Config 3,4			-62.2/38.16MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\text{CMAX, f,c}}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 1	As defined in A.3.8.2.
Propagation Condition			-	AWGN	

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

Note 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.

Note 3: Void

Note 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.4.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.4.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in Clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4, the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission..

A.4.3.2.2.1.2.5 Void

ClauseA.4.3.2.2.1.2.6 Void

ClauseA.4.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in Clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.4.3.2.2.2 Non-contention based random access test in FR1 for PSCell in EN-DC

A.4.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in Table A.4.3.2.2.2.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in Table A.4.3.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.4.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR1 for PSCell in EN-DC

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.4.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR1 for PSCell in EN-DC

Parameter			Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1,2			SSB pattern 3 in FR1	SSB pattern 3 in FR1	As defined in A.3.10
	Config 3,4			SSB pattern 4 in FR1	SSB pattern 4 in FR1	
CSI-RS Configuration	Config 1,2			N/A	CSI-RS.1.1 FDD	As defined in A.3.1.4
	Config 3,4				CSI-RS.2.1 TDD	
Duplex Mode for Cell 2	Config 1,2			FDD	FDD	
	Config 3,4			TDD	TDD	
TDD Configuration	Config 3,4			TDDConf.2.1	TDDConf.2.1	
OCNG Pattern Note 1				OCNG pattern 1	OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 4	Config 1,2			SR.1.1 FDD	SR.1.1 FDD	As defined in A.3.1.1.
	Config 3,4			SR.2.1 TDD	SR.2.1 TDD	
NR RF Channel Number				1	1	
EPRE ratio of PSS to SSS			dB	0	0	
EPRE ratio of PBCH_DMRS to SSS			dB			
EPRE ratio of PBCH to PBCH_DMRS			dB			
EPRE ratio of PDCCH_DMRS to SSS			dB			
EPRE ratio of PDCCH to PDCCH_DMRS			dB			
EPRE ratio of PDSCH_DMRS to SSS			dB			
EPRE ratio of PDSCH to PDSCH_DMRS			dB			
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	3	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15kHz	-98	-98	
		Config 3,4		-101	-101	
	$\hat{E}_s/N_{oc}$		dB	3	3	
	SS-RSRP Note 3		dBm/ SCS	-95	-95	
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-17	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15kHz	-98	-98	
		Config 3,4		-101	-101	
	$\hat{E}_s/N_{oc}$		dB	-17	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	-115	
Io Note 2	Config 1,2		dBm	-65.3/9.36MHz	-65.3/9.36MHz	For symbols without SSB index 1
	Config 3,4			-62.2/38.16MHz	-62.2/38.16MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\text{CMAX, f,c}}$)			dBm	23	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 2	FR1 PRACH configuration 3	As defined in A.3.8.2.
Propagation Condition			-	AWGN	AWGN	

Note 1:	OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2:	SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
Note 3:	Void
Note 4:	The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.4.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.4.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2.. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in Clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.3 2-step RA type contention based random access test in FR1 for PSCell in EN-DC

A.4.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behaviour of the random access procedure is according to the requirements and that the MsgA PRACH, MsgA PUSCH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in Table A.4.3.2.2.3.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in Table A.4.3.2.2.3.1-2.

Table A.4.3.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access test in FR1 for PSCell in EN-DC

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.4.3.2.2.3.1-2: General test parameters for 2-step RA type contention based random access test in FR1 for PSCell in EN-DC

Parameter			Unit	Test-1	Comments
SSB Configuration		Config 1,2		SSB pattern 3 in FR1	As defined in A.3.10
		Config 3,4		SSB pattern 4 in FR1	
Duplex Mode for Cell 2		Config 1,2		FDD	
		Config 3,4		TDD	
TDD Configuration		Config 3,4		TDDConf.2.1	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1,2		SR.1.1 FDD	As defined in A.3.1.1.
		Config 3,4		SR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s/N_{oc}$		dB	3	
	SS-RSRP Note 2		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s/N_{oc}$		dB	-17	
	SS-RSRP Note 2		dBm/ SCS	-115	
Io		Config 1,2	dBm	-65.3/9.36MHz	For symbols without SSB index 1
		Config 3,4		-62.2/38.16MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\text{CMAX, f,c}}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 1	As defined in A.3.20.2.1.
msgA-RSRP-ThresholdSSB			dBm	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
Propagation Condition			-	AWGN	
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel. Note 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters. Note 3: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.					

A.4.3.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.4.3.2.2.3.2.1 MsgA Transmission

To test the UE behaviour specified in Clause 6.2.2.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first MsgA preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.3.2.2 MsgB Reception

To test the UE behaviour specified in Clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB with fallbackRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first MsgA preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.3.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB with fallbackRAR containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first MsgA preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS

38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.4 Non-contention based random access test for 2-step RA type in FR1 for PSCell in EN-DC

A.4.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell in FR1. Supported test parameters are shown in Table A.4.3.2.2.4.1-1. UE capable of EN-DC with PSCell in FR1 needs to be tested by using the parameters in Table A.4.3.2.2.4.1-2.

Table A.4.3.2.2.4.1-1: Supported test configurations for non-contention based random access test for 2-step RA type in FR1 for PSCell in EN-DC

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.4.3.2.2.4.1-2: General test parameters for non-contention based random access test for 2-step RA type in FR1 for PSCell in EN-DC

Parameter			Unit	Test-1	Comments
SSB Configuration		Config 1,2		SSB pattern 3 in FR1	As defined in A.3.10
		Config 3,4		SSB pattern 4 in FR1	
Duplex Mode for Cell 2		Config 1,2		FDD	
		Config 3,4		TDD	
TDD Configuration		Config 3,4		TDDConf.2.1	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1,2		SR.1.1 FDD	As defined in A.3.1.1.
		Config 3,4		SR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s/N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1,2	dBm/15kHz	-98	
		Config 3,4		-101	
	$\hat{E}_s/N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1,2	dBm	-65.3/9.36MHz	For symbols without SSB index 1
		Config 3,4		-62.2/38.16MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 2	As defined in A.3.20.2.
msgA-RSRP-ThresholdSSB			dBm	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
Propagation Condition			-	AWGN	

Note 1:	OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2:	SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
Note 3:	The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.4.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.4.3.2.2.4.2.1 MsgA Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.3.2.1 for MsgA transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all MsgA transmission shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] , where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble after 5 MsgA transmissions have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB if the MsgB contains a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA transmission power if Random Access Responses Reception has not been considered as successful.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] , where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18] , where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.4.3.2.3 Void

A.4.4 Timing

A.4.4.1 UE transmit timing

A.4.4.1.1 NR UE Transmit Timing Test for FR1

A.4.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2. Supported test configurations are shown in Table 4.4.1.1.1-1.

Table A.4.4.1.1.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	LTE FDD, NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	LTE FDD, NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
4	LTE TDD, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
5	LTE TDD, NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
6	LTE TDD, NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
Note: The UE is only required to be tested in one of the supported test configurations	

The test consists of E-UTRA PCell and NR PSCell. The configuration for E-UTRA is given in A.3.7.2.1. Table A.4.4.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.4.4.1.1.1-3.

Table A.4.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2	Band Group
SSB ARFCN		1,2,3,4,5,6	Freq1	Freq1	
Duplex Mode		1,4	FDD		
		2,3,5,6	TDD		
TDD configuration		1,4	Not Applicable		
		2,5	TDDConf.1.1		
		3,6	TDDConf.1.2		
$BW_{channel}$	MHz	1,4	10: $N_{RB,c}$ = 52		
		2,5	10: $N_{RB,c}$ = 52		
		3,6	40: $N_{RB,c}$ = 106		
Initial BWP Configuration		1,2,3,4,5,6	DLBWP.0.1 ULBWP.0.1		
Dedicated BWP Configuration		1,2,3,4,5,6	DLBWP.1.1 ULBWP.1.1		
DRx Cycle	ms	1,2,3,4,5,6	N/A	DRX.8[Note5]	
PDSCH Reference measurement channel		1,4	SR.1.1 FDD		
		2,5	SR.1.1 TDD		
		3,6	SR.2.1 TDD		
CORESET Reference Channel		1,4	CR.1.1 FDD		
		2,5	CR.1.1 TDD		
		3,6	CR.2.1 TDD		
OCNG Patterns		1,2,3,4,5,6	OCNG pattern 1		
SSB configuration		1,4	SSB.1 FR1		
		2,5	SSB.1 FR1		
		3,6	SSB.2 FR1		
SMTC configuration		1,2,3,4,5,6	SMTC.2		
TRS configuration		1,4	TRS.1.1 FDD		
		2,5	TRS.1.1 TDD		
		3,6	TRS.1.2 TDD		
PDSCH/PDCCH subcarrier spacing	kHz	1,2,4,5	15		
		3,6	30		
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} [Note2]	dBm/15 kHz	1,2,3,4,5,6	-98	-98	
N_{oc} [Note2]	dBm/SCS	1,2,4,5	-98	-98	
		3,6	-95	-95	
$\hat{E}_s/I_{ot}$		1,2,3,4,5,6	3	3	
$\hat{E}_s/N_{oc}$		1,2,3,4,5,6	3	3	
SS-RSRP[Note3]	dBm/SCS	1,2,4,5	-95	-95	

		3,6	-92	-92	
Io[Note3]	dBm/9.36MHz	1,2,4,5	-65.2	-65.2	
	dBm/38.1MHz	3,6	-59.2	-59.2	
Propagation condition		1,2,3,4,5,6	AWGN		
SRS Config		1,2,4,5	SRSConf.1[Note6]	SRSConf.3[Note6]	
		3, 6	SRSConf.1[Note6]	SRSConf.2[Note6]	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: DRx related parameters are given in Table A.3.3.8-1
Note 6: SRS configs are given in Table A.4.4.1.1.1-3

Table A.4.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	SRSConf.3	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	0	
	srs-ResourceIdList	0	0	0	
	resourceType	Periodic	Periodic	Periodic	
	Usage	Codebook	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	0	
	nrofSRS-Ports	Port1	Port1	Port1	
	transmissionComb	n2	n2	n2	
	combOffset-n2	0	0	0	
	cyclicShift-n2	0	0	0	
	resourceMapping startPosition	0	0	0	
	resourceMapping nrofSymbols	n1	n1	n1	
	resourceMapping repetitionFactor	n1	n1	n1	
	freqDomainPosition	0	0	0	
	freqDomainShift	0	0	0	
	freqHopping c-SRS	14 for test configuration 1,2,4,5 25 for test configuration 3,6	25	14	Matches $N_{RB,c}$
	freqHopping b-SRS	0	0	0	
	freqHopping b-hop	0	0	0	
	groupOrSequenceHopping	Neither	Neither	Neither	
	resourceType	Periodic	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl640, 5	sl320, 3	Offset to align with DRx periodicity
	sequenceId	0	0	0	Any 10 bit number

A.4.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in Table A.3.7.2.1-1 and setup NR PSCell according to parameters given in Table A.4.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.

   a. The N_{TA} offset value (in T_c units) is 25600

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.4.4.1.1.2-1

Table A.4.4.1.1.2-1: Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
15	+64*64T_c	+32*64T_c
30	+32*64T_c	+16*64T_c

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.4.4.2 UE timer accuracy

A.4.4.3 Timing advance

A.4.4.3.1 EN-DC FR1 timing advance adjustment accuracy

A.4.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.4.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.4.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.4.4.3.1.2-2, A.4.4.3.1.2-3 and A.4.4.3.1.2-4. The configuration of Cell 1 (LTE PCell) is specified in clause A.3.7.2.1.

In all test cases, two cells are used. Cell 1 is the PCell in the primary Timing Advance Group (pTAG) and cell 2 is the PSCell is in the secondary Timing Advance Group (sTAG). Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands for sTAG are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.4.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured for PSCell in sTAG.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value specified in table A.4.4.3.1.2-2. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

Table A.4.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		Cell 1: 1 Cell 2: 2	1 for E-UTRAN PCell 2 for NR PSCell
Initial DL BWP		DLBWP.0.1	As specified in Table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in Table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in Table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in Table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA\_new} = N_{TA\_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	*For 15 kHz SCS* $N_{TA\_new} = N_{TA\_old} + 8192*T_c$ *For 30 kHz SCS* $N_{TA\_new} = N_{TA\_old} + 4096*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.4.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter		Unit	Test1	
			T1	**T2**
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
TDD configuration	Config 1,4		Not Applicable	

	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
BWP BW	Config 1,4	MHz	10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
DRx Cycle		ms	Not Applicable
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR2.1 TDD
CORESET Reference Channel	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns			OCNG pattern 1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC configuration	Config 1,2,4,5		SMTC.1 FR1
	Config 3,6		SMTC.2 FR1
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz
	Config 3,6		30 kHz
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz
	Config 3,6		30 kHz
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note2		dBm/15kHz	-98
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-98
	Config 3,6		-95
$\hat{E}_s/I_{ot}$		dB	3
$\hat{E}_s/N_{oc}$		dB	3
Io Note3	Config 1,2,4,5	dBm/9.36MHz	-67.57
	Config 3,6	dBm/38.16MHz	-62.58
Propagation condition		-	AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

Table A.4.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field		Value	Comment
c-SRS	Config 1,2,4,5	12	Frequency hopping is disabled
	Config 3,6	24	
b-SRS		0	
b-hop		0	
freqDomainPosition		0	Frequency domain position of SRS
freqDomainShift		0	
groupOrSequenceHopping		neither	No group or sequence hopping
SRS-PeriodicityAndOffset		sl5=2 for SCS 15kHz sl5=4 for SCS 30kHz	Once every 5 slots
pathlossReferenceRS		ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage		Codebook	Codebook based UL transmission
startPosition		0	resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition.
nrofSymbols		n1	
repetitionFactor		n1	
combOffset-n2		0	transmissionComb setting
cyclicShift-n2		0	
nrofSRS-Ports		port1	Number of antenna ports used for SRS transmission
Note: For further information see clause 6.3.2 in TS 38.331 [2].			

A.4.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value for PSCell in sTAG to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy for PSCell in sTAG shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

A.4.5 Signaling characteristics

A.4.5.1 Radio link Monitoring

In the following clause, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

- UE output power higher than Transmit OFF power -50 dBm (as defined in TS 38.101-3 [20]) means uplink signal
- UE output power equal to or less than Transmit OFF power -50 dBm (as defined in TS 38.101-3 [20]) means no uplink signal.

A.4.5.1.1 Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS in non-DRX mode

A.4.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.1.1-1. The test parameters are given in Tables A.4.5.1.1.1-2, A.4.5.1.1.1-3, and A.4.5.1.1.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.1.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 1.

Table A.4.5.1.1.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.1.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode

Parameter			Unit	Value
				Test 1
Active E-UTRA PCell				Cell 1
E-UTRA RF Channel Number				1
Active PSCell				Cell 2
RF Channel Number				2
Duplex mode		Config 1, 4		FDD
		Config 2, 3, 5, 6		TDD
$BW_{channel}$		Config 1, 4	MHz	10: $N_{RB,c}$ = 52
		Config 2, 5		10: $N_{RB,c}$ = 52
		Config 3, 6		40: $N_{RB,c}$ = 106
DL initial BWP configuration		Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration		Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration		Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration		Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration		Config 1, 4		Not Applicable
		Config 2, 5		TDDConf.1.1
		Config 3, 6		TDDConf.2.1
CORESET Reference Channel		Config 1, 4		CR.1.1 FDD
		Config 2, 5		CR.1.1 TDD
		Config 3, 6		CR.2.1 TDD
SSB Configuration		Config 1, 4		SSB.1 FR1
		Config 2, 5		SSB.1 FR1
		Config 3, 6		SSB.2 FR1
SMTC Configuration		Config 1, 2, 4, 5		SMTC.1
		Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing		Config 1, 2, 4, 5		15 kHz
		Config 3, 6		30 kHz
PRACH Configuration		Config 1, 2, 4, 5		Table A.3.8.2.1-1
		Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS				0
OCNG parameters				OP.1
CP length				Normal
Correlation Matrix and Antenna Configuration				2x2 Low
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX				*OFF*
Gap pattern ID				*gp0*
Layer 3 filtering				*Enabled*
T310 timer			ms	*0*
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI		Config 1, 4		CSI-RS.1.1 FDD

reporting	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.1.1-3: Cell specific test parameters for FR1 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2, 5		1	-7	-15
	Config 3, 6		1	-7	-15
SNR on other channels and signals	Config 1, 2, 3, 4, 5, 6	dB	1		
N_{oc}	Config 1, 4	dBm/15 kHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2, 5		-98		
	Config 3, 6		-95		
Propagation condition			TDL-C 300ns 100Hz		
Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.					

Table A.4.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap).	

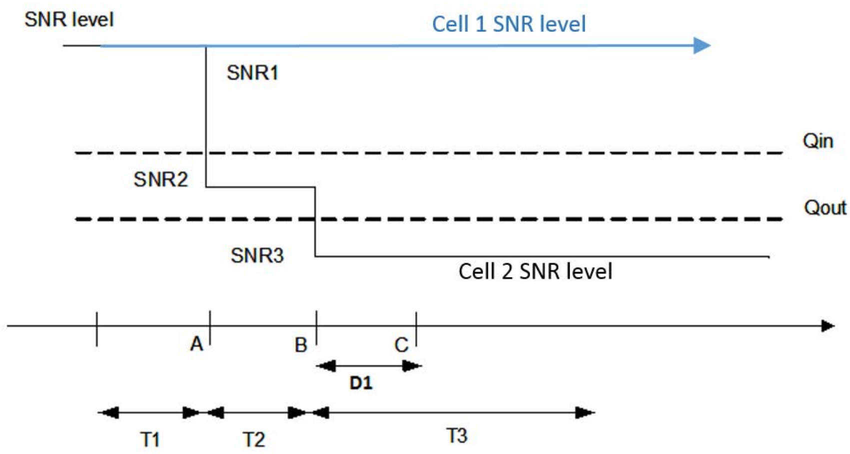


Figure A.4.5.1.1.1-1: SNR variation for out-of-sync testing

A.4.5.1.1.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.2 Radio Link Monitoring In-sync Test for FR1 PSCell configured with SSB-based RLM RS in non-DRX mode

A.4.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR1 PSCell radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.2.1-1. The test parameters are given in Tables A.4.5.1.2.1-2, and A.4.5.1.2.1-3 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.2.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.4.5.1.2.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.2.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52
	Config 2, 5		10: $N_{RB,c}$ = 52
	Config 3, 6		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 kHz
	Config 3, 6		30 kHz
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.1-1
	Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0

	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.2.1-3: Cell specific test parameters for FR1 (Cell 2) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	4				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2, 5		1	-7	-15	-4.5	1
	Config 3, 6		1	-7	-15	-4.5	1
SNR on other channels and signals	Config 1, 2, 3, 4, 5, 6	dB	1				
N_{oc}	Config 1, 4	dBm/15 kHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
N_{oc}	Config 1, 4	dBm/SCS	-98				
	Config 2, 5		-98				
	Config 3, 6		-95				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.4.5.1.2.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.

Table A.4.5.1.2.1-4: Void

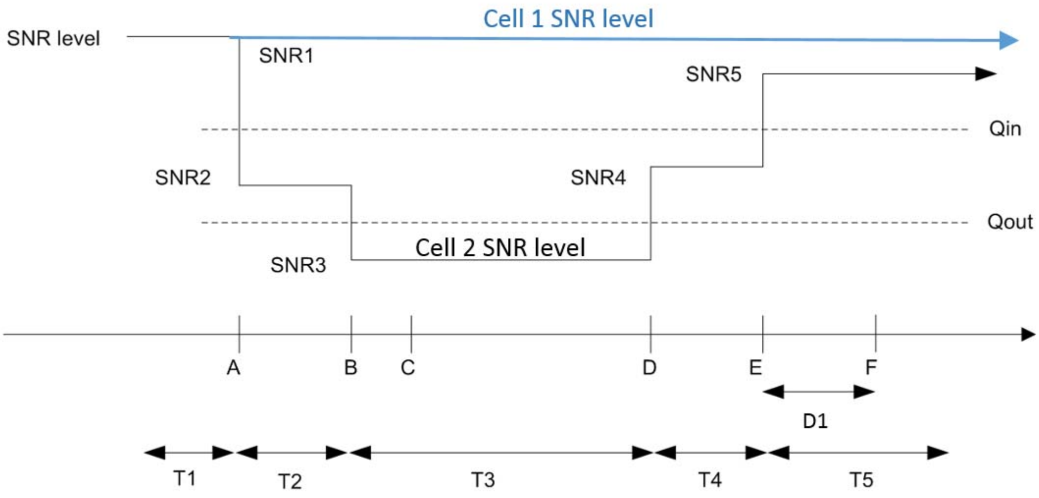


Figure A.4.5.1.2.1-1: SNR variation for in-sync testing

A.4.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.3 Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with SSB-based RLM RS in DRX mode

A.4.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.3.1-1. The test parameters are given in Tables A.4.5.1.3.1-2 and A.4.5.1.3.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.3.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.4.5.1.3.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.3.1-2: General test parameters for FR1 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52
	Config 2, 5		10: $N_{RB,c}$ = 52
	Config 3, 6		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 kHz
	Config 3, 6		30 kHz
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.1-1
	Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3

Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2
T2		s	0.68
T3		s	0.68
D1		s	0.64
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.3.1-3: Cell specific test parameters for FR1 (Cell 2) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2, 5		1	-7	-15
	Config 3, 6		1	-7	-15
SNR on other channels and signals	Config 1, 2, 3, 4, 5, 6	dB	1		
N_{oc}	Config 1, 4	dBm/15kHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
N_{oc}	Config 1, 4	dBm/SCS	-98		
	Config 2, 5		-98		
	Config 3, 6		-95		
Propagation condition			TDL-C 300ns 100Hz		
Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs. Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.4.5.1.3.1-1. Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.					

Table A.4.5.1.3.1-4: Void

Table A.4.5.1.3.1-5: Void

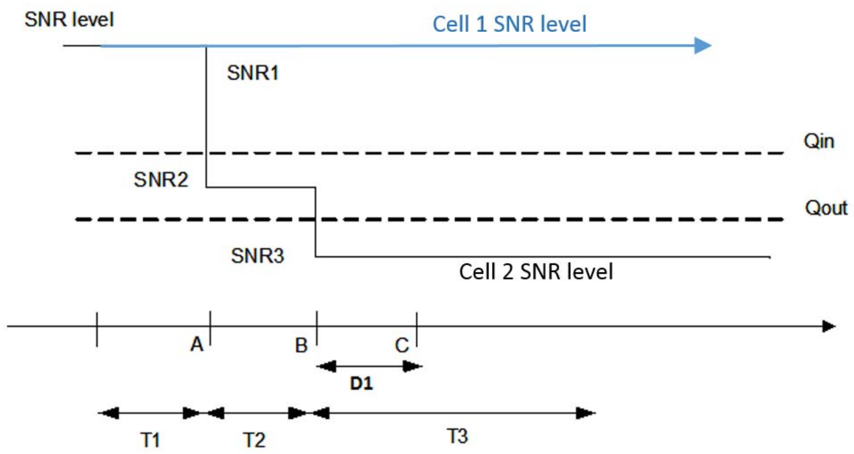


Figure A.4.5.1.3.1-1: SNR variation for out-of-sync testing

A.4.5.1.3.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.4 Radio Link Monitoring In-sync Test for FR1 PSCell configured with SSB-based RLM RS in DRX mode

A.4.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.4.5.1.4.1-1. The test parameters are given in Tables A.4.5.1.4.1-2, and A.4.5.1.4.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-1. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.4.1-1 shows the variation of the downlink SNR in the active Cell 2 to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.4.5.1.4.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.4.1-2: General test parameters for FR1 in-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52
	Config 2, 5		10: $N_{RB,c}$ = 52
	Config 3, 6		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 kHz
	Config 3, 6		30 kHz
PRACH Configuration	Config 1, 2, 4, 5		Table A A.3.8.2.1-1
	Config 3, 6		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8

	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.64
T4		s	0.2
T5		s	0.88
D1		s	0.84
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.4.1-3: Cell specific test parameters for FR1 (Cell 2) for in-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	4				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2, 5		1	-7	-15	-4.5	1
	Config 3, 6		1	-7	-15	-4.5	1
SNR on other channels and signals	Config 1, 2, 3, 4, 5, 6	dB	1				
N_{oc}	Config 1, 4	dBm/15 kHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
N_{oc}	Config 1, 4	dBm/SCS	-98				
	Config 2, 5		-98				
	Config 3, 6		-95				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.4.5.1.4.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.

Table A.4.5.1.4.1-4: Void

Table A.4.5.1.4.1-5: Void

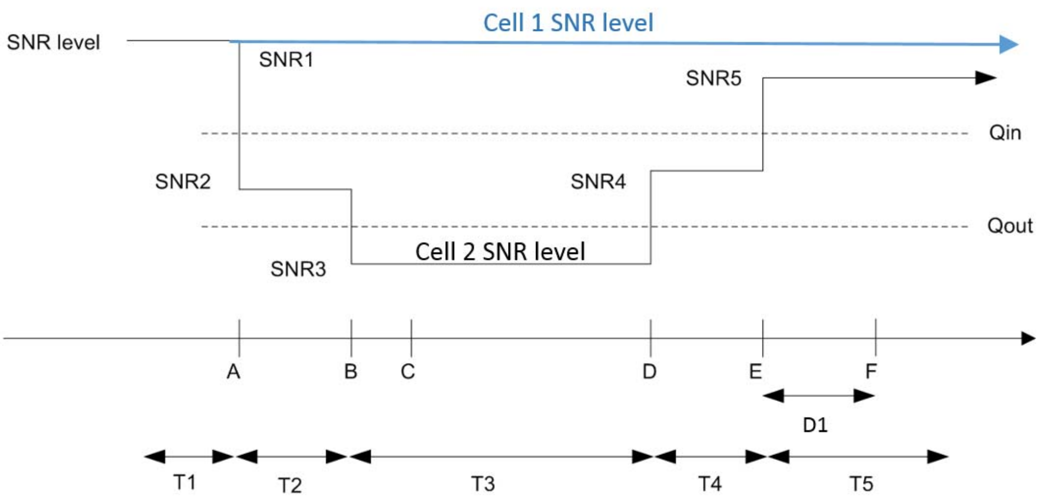


Figure A.4.5.1.4.1-1: SNR variation for in-sync testing

A.4.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.5 EN-DC Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with CSI-RS-based RLM in non-DRX mode

A.4.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.4.5.1.5.1-1, A.4.5.1.5.1-2, A.4.5.1.5.1-3, and A.4.5.1.5.1-3A below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.5.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms). In the test, SSB0 is configured as the BFD-RS.

Table A.4.5.1.5.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.5.1-2: General test parameters for FR1 PSCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
RMC CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz
	Config 3, 6		30 KHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2, 5		Resource #4 in TRS.1.1 TDD
	Config 3, 6		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State.0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1

N311			1
CSI-RS for reporting	Config 1, 4		CSI-RS1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.5.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
PDCCH_beta		dB	4		
PDCCH_DMRS_beta		dB	4		
PBCH_beta		dB	0		
PSS_beta		dB			
SSS_beta		dB			
PDSCH_beta		dB			
OCNG_beta		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2, 5		1	-7	-15
	Config 3, 6		1	-7	-15
SNR on other channels and signals	Config 1, 4	dB	1		
	Config 2, 5		1		
	Config 3, 6		1		
N_{oc}	Config 1, 4	dBm/15KHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
Propagation condition			TDL-C 300ns 100Hz		
Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1. Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs. Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.1.5.1-1. Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1..					

Table A.4.5.1.5.1-3A: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned.	

Table A.4.5.1.5.1-4: Void

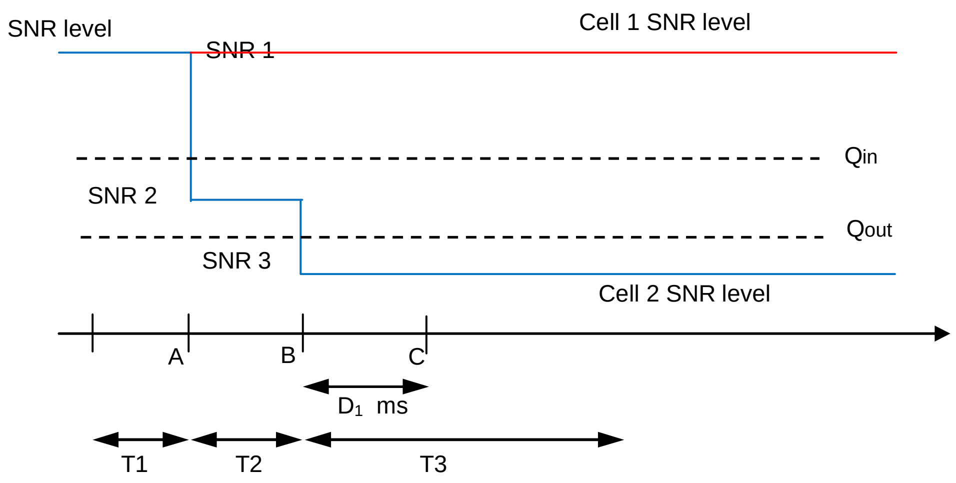


Figure A.4.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.4.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C (D_1 after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.6 EN-DC Radio Link Monitoring In-sync Test for FR1 PSCell configured with CSI-RS-based RLM in non-DRX mode

A.4.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.4.5.1.6.1-1, A.4.5.1.6.1-2, and A.4.5.1.6.1-3 below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.6.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. In the test, SSB0 is configured as the BFD-RS.

Table A.4.5.1.6.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.6.1-2: General test parameters for FR1 PSCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
RMC CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz
	Config 3, 6		30 KHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2, 5		Resource #4 in TRS.1.1 TDD
	Config 3, 6		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State.0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0

	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.44
T4		s	0.2
T5		s	0.88
T6		s	0.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.6.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
PDCCH_beta		dB	4				
PDCCH_DMRS_beta		dB	4				
PBCH_beta		dB	0				
PSS_beta		dB					
SSS_beta		dB					
PDSCH_beta		dB					
OCNG_beta		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2, 5		1	-7	-15	-4.5	1
	Config 3, 6		1	-7	-15	-4.5	1
SNR on other channels and signals	Config 1, 4	dB	1				
	Config 2, 5		1				
	Config 3, 6		1				
N_{oc}	Config 1, 4	dBm/15KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.4.5.1.6.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1..

Table A.4.5.1.6.1-3A: Void

Table A.4.5.1.6.1-4: Void

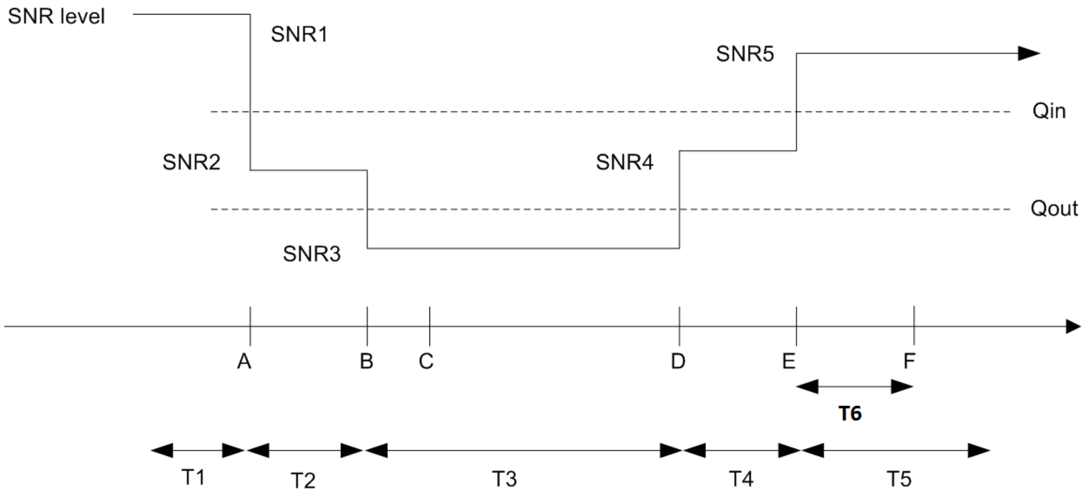


Figure A.4.5.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.4.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.7 EN-DC Radio Link Monitoring Out-of-sync Test for FR1 PSCell configured with CSI-RS-based RLM in DRX mode

A.4.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.4.5.1.7.1-1, A.4.5.1.7.1-2, and A.4.5.1.7.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.4.5.1.7.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS.

Table A.4.5.1.7.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.7.1-2: General test parameters for FR1 PSCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
RMC CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz
	Config 3, 6		30 KHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2, 5		Resource #4 in TRS.1.1 TDD
	Config 3, 6		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State.0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0

T311 timer		ms	1000
N310			1
N311			1
CSI-RS for reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.7.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
PDCCH_beta		dB	4		
PDCCH_DMRS_beta		dB	4		
PBCH_beta		dB	0		
PSS_beta		dB			
SSS_beta		dB			
PDSCH_beta		dB			
OCNG_beta		dB			
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15
	Config 2, 5		1	-7	-15
	Config 3, 6		1	-7	-15
SNR on other channels and signals	Config 1, 4	dB	1		
	Config 2, 5		1		
	Config 3, 6		1		
N_{oc}	Config 1, 4	dBm/15KHz	-98		
	Config 2, 5		-98		
	Config 3, 6		-98		
Propagation condition			TDL-C 300ns 100Hz		
Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1. Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs. Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.1.7.1-1. Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1..					

Table A.4.5.1.7.1-3A: Void

Table A.4.5.1.7.1-4: Void

Table A.4.5.1.7.1-5: Void

Table A.4.5.1.7.1-6: Void

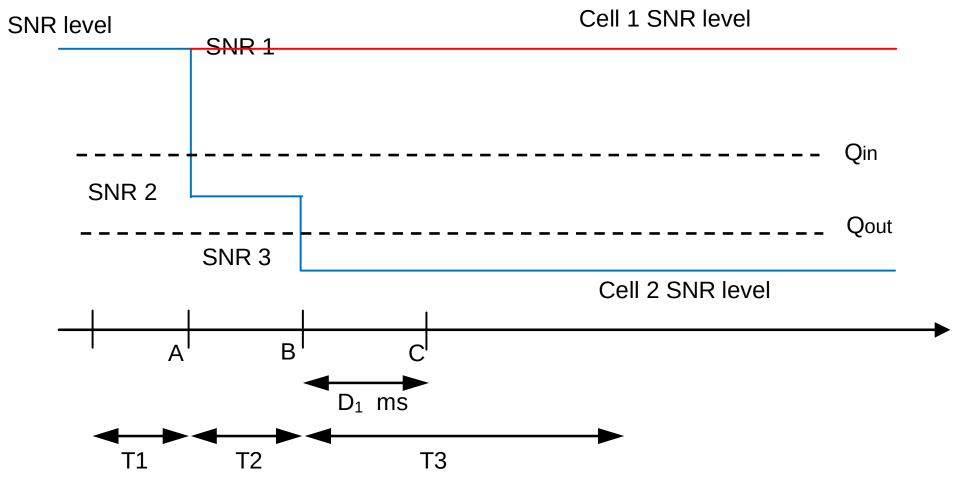


Figure A.4.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.4.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C (D_1 after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.1.8 EN-DC Radio Link Monitoring In-sync Test for FR1 PSCell configured with CSI-RS-based RLM in DRX mode

A.4.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR1 PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.4.5.1.8.1-1, A.4.5.1.8.1-2, A.4.5.1.8.1-3 and A.4.5.1.8.1-3A below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the NR PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.1.8.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms). In the test, SSB0 is configured as the BFD-RS.

Table A.4.5.1.8.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.1.8.1-2: General test parameters for FR1 PSCell for CSI-RS in-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		Not Applicable
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1
RMC CORESET Reference Channel	Config 1, 4		CCR.1.1 FDD
	Config 2, 5		CCR.1.1 TDD
	Config 3, 6		CCR.2.1 TDD
SSB Configuration	Config 1, 4		SSB.1 FR1
	Config 2, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1
	Config 3, 6		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz
	Config 3, 6		30 KHz
TRS configuration	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
CSI-RS for RLM	Config 1, 4		Resource #4 in TRS.1.1 FDD
	Config 2, 5		Resource #4 in TRS.1.1 TDD
	Config 3, 6		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State.0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0

	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for reporting	Config 1, 4		CSI-RS.1.1 FDD
	Config 2, 5		CSI-RS.1.1 TDD
	Config 3, 6		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	1.24
T4		s	0.2
T5		s	1.88
T6		s	1.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.			

Table A.4.5.1.8.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
PDCCH_beta		dB	4				
PDCCH_DMRS_beta		dB	4				
PBCH_beta		dB	0				
PSS_beta		dB					
SSS_beta		dB					
PDSCH_beta		dB					
OCNG_beta		dB					
SNR on RLM-RS	Config 1, 4	dB	1	-7	-15	-4.5	1
	Config 2, 5		1	-7	-15	-4.5	1
	Config 3, 6		1	-7	-15	-4.5	1
SNR on other channels and signals	Config 1, 4	dB	1				
	Config 2, 5		1				
	Config 3, 6		1				
N_{oc}	Config 1, 4	dBm/15KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.4.5.1.8.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

Table A.4.5.1.8.1-3A: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in DRX mode

Field	Test 1
	Value
gapOffset	0

Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned.

Table A.4.5.1.8.1-4: Void

Table A.4.5.1.8.1-5: Void

Table A.4.5.1.8.1-6: Void

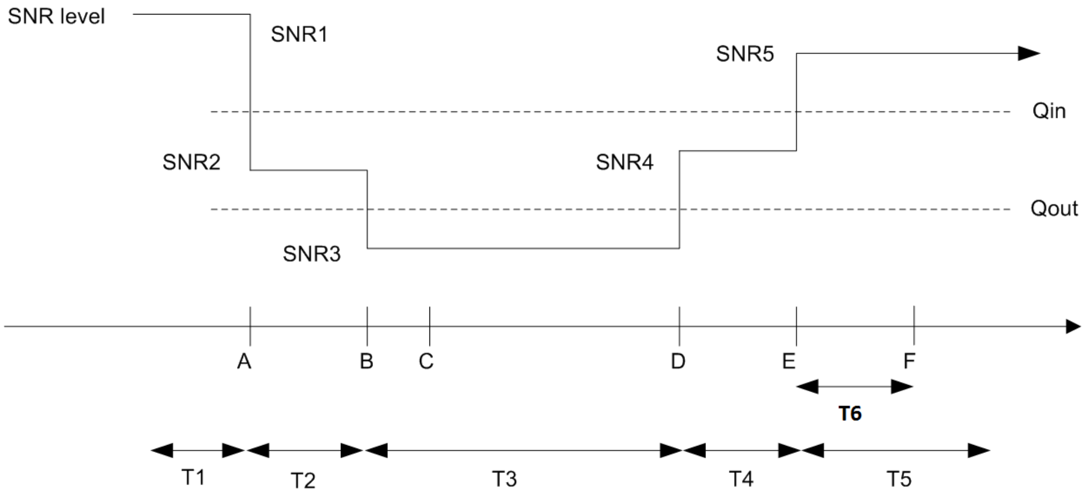


Figure A.4.5.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.4.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2 Interruption

A.4.5.2.1 E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

A.4.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in TS38.133 clause 8. 2.1.2. Supported test configurations are shown in table A.4.5.2.1.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.1.1-2 and A.4.5.2.1.1-3. The E-UTRAN PCell DRX configuration parameters are given in Table A.4.5.2.1.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR FR1 PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell1 and Cell2. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. CORESET indicating a new transmission on PSCell shall be sent continuously during the entire time duration to ensure UE would not enter DRX state on PSCell.

Table A.4.5.2.1.1-1: Interruption at transitions between active and non-active during DRX supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.1.1-2: General test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell1 and Cell2
DRX		DRX.4	DRX related parameters are defined in Table A.3.3.4-1
Measurement gap pattern Id		OFF	
T1	s	10	

Table A.4.5.2.1.1-3: NR cell specific test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter		Unit	Cell2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS (Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36MHz	-58.96
	Config 3,6	dBm/38.16MHz	-52.86
Time offset to Cell1 Note 4		µs	33

Propagation Condition		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess. Note 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells		

Table A.4.5.2.1.1-4: Void

A.4.5.2.1.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed X as defined in Table A.4.5.2.1.2-1.

Table A.4.5.2.1.2-1: Interruption length X at transition between active and non-active during DRX

μ	NR Slot length (ms)	Interruption length X
		Sync
0	1	1
1	0.5	1

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.2 E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

A.4.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in TS 38.133 clause 8.2.1.2. Supported test configurations are shown in table A.4.5.2.2.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.2.1-2 and A.4.5.2.2.1-3. The E-UTRAN PCell DRX configuration parameters are given in Table A.4.5.2.2.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR FR1 PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. PDCCH indicating a new transmission on PSCell shall be sent continuously during the entire time duration to ensure UE would not enter DRX state on PSCell.

Table A.4.5.2.2.1-1: Interruption at transitions between active and non-active during DRX supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.2.1-2: General test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell1 and Cell2
DRX		DRX.4	DRX related parameters are defined in Table A.3.3.4-1
Measurement gap pattern Id		OFF	
T1	s	10	

Table A.4.5.2.2.1-3: NR cell specific test parameters for E-UTRAN – NR FR1 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter		Unit	Cell2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36MHz	-58.96
	Config 3,6	dBm/38.16MHz	-52.86
Time offset to Cell1 Note 4		µs	500

Propagation Condition		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess. Note 4: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells		

Table A.4.5.2.2.1-4: Void

A.4.5.2.2.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed X as defined in Table A.4.5.2.2.2-1.

Table A.4.5.2.2.2-1: Interruption length X at transition between active and non-active during DRX

μ	NR Slot length (ms)	Interruption length X
		Async
0	1	2
1	0.5	2

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.3 E-UTRAN – NR FR1 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

A.4.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in TS 38.133 clause 8.2.1.2. Supported test configurations are shown in table A.4.5.2.3.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.3.1-2 and A.4.5.2.3.1-3 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell1, Cell2 and Cell3. Cell1 is LTE PCell, Cell2 and Cell3 is NR PSCell and NR deactivated SCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.4.5.2.3.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.3.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Active PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 3.
CP length		Normal	Applicable to Cell1, Cell2 and Cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.4.5.2.3.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in synchronous EN-DC

<table>
<tr><th colspan="2">Parameter</th><th>Unit</th><th>Cell2</th><th>Cell3</th></tr>
<tr><th colspan="2">Frequency Range</th><td></td><td>FR1</td><td>FR1</td></tr>
<tr><td rowspan="2">Duplex mode</td><td>Config 1,4</td><td rowspan="2"></td><td>FDD</td><td>FDD</td></tr>
<tr><td>Config 2,3,5,6</td><td>TDD</td><td>TDD</td></tr>
<tr><td rowspan="3">TDD configuration</td><td>Config 1,4</td><td rowspan="3"></td><td>Not Applicable</td><td>Not Applicable</td></tr>
<tr><td>Config 2,5</td><td>TDDConf.1.1</td><td>TDDConf.1.1</td></tr>
<tr><td>Config 3,6</td><td>TDDConf.2.1</td><td>TDDConf.2.1</td></tr>
<tr><td rowspan="3">$BW_{channel}$</td><td>Config 1,4</td><td rowspan="3"></td><td>10: $N_{RB,c}$ = 52</td><td>10: $N_{RB,c}$ = 52</td></tr>
<tr><td>Config 2,5</td><td>10: $N_{RB,c}$ = 52</td><td>10: $N_{RB,c}$ = 52</td></tr>
<tr><td>Config 3,6</td><td>40: $N_{RB,c}$ = 106</td><td>40: $N_{RB,c}$ = 106</td></tr>
<tr><td rowspan="3">Initial DL BWP Configuration</td><td>Config 1,4</td><td rowspan="3"></td><td>DLBWP.0.1</td><td>DLBWP.0.1</td></tr>
<tr><td>Config 2,5</td><td>DLBWP.0.1</td><td>DLBWP.0.1</td></tr>
<tr><td>Config 3,6</td><td>DLBWP.0.1</td><td>DLBWP.0.1</td></tr>
<tr><td rowspan="3">Dedicated DL BWP Configuration</td><td>Config 1,4</td><td rowspan="3"></td><td>DLBWP.1.1</td><td>DLBWP.1.1</td></tr>
<tr><td>Config 2,5</td><td>DLBWP.1.1</td><td>DLBWP.1.1</td></tr>
<tr><td>Config 3,6</td><td>DLBWP.1.1</td><td>DLBWP.1.1</td></tr>
<tr><td rowspan="3">Initial UL BWP Configuration</td><td>Config 1,4</td><td rowspan="3"></td><td>ULBWP.0.1</td><td>ULBWP.0.1</td></tr>
<tr><td>Config 2,5</td><td>ULBWP.0.1</td><td>ULBWP.0.1</td></tr>
<tr><td>Config 3,6</td><td>ULBWP.0.1</td><td>ULBWP.0.1</td></tr>
<tr><td rowspan="3">Dedicated UL BWP Configuration</td><td>Config 1,4</td><td rowspan="3"></td><td>ULBWP.1.1</td><td>ULBWP.1.1</td></tr>
<tr><td>Config 2,5</td><td>ULBWP.1.1</td><td>ULBWP.1.1</td></tr>
<tr><td>Config 3,6</td><td>ULBWP.1.1</td><td>ULBWP.1.1</td></tr>
<tr><td rowspan="3">PDSCH Reference measurement channel</td><td>Config 1,4</td><td rowspan="3"></td><td>SR.1.1 FDD</td><td>-</td></tr>
<tr><td>Config 2,5</td><td>SR.1.1 TDD</td><td>-</td></tr>
<tr><td>Config 3,6</td><td>SR.2.1 TDD</td><td>-</td></tr>
<tr><td rowspan="3">RMSI CORESET parameters</td><td>Config 1,4</td><td rowspan="3"></td><td>CR.1.1 FDD</td><td>CR.1.1 FDD</td></tr>
<tr><td>Config 2,5</td><td>CR.1.1 TDD</td><td>CR.1.1 TDD</td></tr>
<tr><td>Config 3,6</td><td>CR.2.1 TDD</td><td>CR.2.1 TDD</td></tr>
<tr><td rowspan="3">PDCCH CORESET parameters</td><td>Config 1,4</td><td rowspan="3"></td><td>CCR.1.1 FDD</td><td>CCR.1.1 FDD</td></tr>
<tr><td>Config 2,5</td><td>CCR.1.1 TDD</td><td>CCR.1.1 TDD</td></tr>
<tr><td>Config 3,6</td><td>CCR.2.1 TDD</td><td>CCR.2.1 TDD</td></tr>
<tr><td rowspan="3">TRS configuration</td><td>Config 1,4</td><td rowspan="3"></td><td>TRS.1.1 FDD</td><td>TRS.1.1 FDD</td></tr>
<tr><td>Config 2,5</td><td>TRS.1.1 TDD</td><td>TRS.1.1 TDD</td></tr>
<tr><td>Config 3,6</td><td>TRS.1.2 TDD</td><td>TRS.1.2 TDD</td></tr>
<tr><td colspan="2">OCNG Patterns</td><td></td><td>OP.1</td><td>OP.1</td></tr>
<tr><td colspan="2">SMTC Configuration</td><td></td><td>SMTC.1</td><td>SMTC.1</td></tr>
<tr><td colspan="2">TCI state</td><td rowspan="3"></td><td>TCI.State.0</td><td>TCI.State.0</td></tr>
<tr><td rowspan="2">SSB Configuration</td><td>Config 1,2,4,5</td><td>SSB.1 FR1</td><td>SSB.1 FR1</td></tr>
<tr><td>Config 3,6</td><td>SSB.2 FR1</td><td>SSB.2 FR1</td></tr>
<tr><td colspan="2">Correlation Matrix and Antenna Configuration</td><td></td><td>1x2 Low</td><td>1x2 Low</td></tr>
<tr><td colspan="2">EPRE ratio of PSS to SSS</td><td rowspan="9">dB</td><td rowspan="9">0</td><td rowspan="9">0</td></tr>
<tr><td colspan="2">EPRE ratio of PBCH DMRS to SSS</td></tr>
<tr><td colspan="2">EPRE ratio of PBCH to PBCH DMRS</td></tr>
<tr><td colspan="2">EPRE ratio of PDCCH DMRS to SSS</td></tr>
<tr><td colspan="2">EPRE ratio of PDCCH to PDCCH DMRS</td></tr>
<tr><td colspan="2">EPRE ratio of PDSCH DMRS to SSS</td></tr>
<tr><td colspan="2">EPRE ratio of PDSCH to PDSCH</td></tr>
<tr><td colspan="2">EPRE ratio of OCNG DMRS to SSS(Note 1)</td></tr>
<tr><td colspan="2">EPRE ratio of OCNG to OCNG DMRS (Note 1)</td></tr>
<tr><td colspan="2">N_{oc} Note 2</td><td>dBm/15 kHz</td><td>-104</td><td>-104</td></tr>
<tr><td colspan="2">SS-RSRP Note 3</td><td>dBm/15 kHz</td><td>-87</td><td>-87</td></tr>
<tr><td colspan="2">$\hat{E}_s/I_{ot}$</td><td>dB</td><td>17</td><td>17</td></tr>
<tr><td colspan="2">$\hat{E}_s/N_{oc}$</td><td>dB</td><td>17</td><td>17</td></tr>
<tr><td rowspan="2">Io Note3</td><td>Config 1,2,4,5</td><td>dBm/9.36MHz</td><td>-58.96</td><td>-58.96</td></tr>
<tr><td>Config 3,6</td><td>dBm/38.16MHz</td><td>-52.86</td><td>-52.86</td></tr>
<tr><td colspan="2">Time offset to Cell1 Note 4</td><td>µs</td><td>33</td><td>33</td></tr>
<tr><td colspan="2">Time offset to Cell2 Note 5</td><td>µs</td><td>-</td><td>3</td></tr>
<tr><td colspan="2">Propagation Condition</td><td></td><td>AWGN</td><td>AWGN</td></tr>
</table>

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4:	Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells
Note 5:	Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.4.5.2.3.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.4.5.2.3.2-1 if the NR PSCell is not in the same band as the deactivated SCell or Table A.4.5.2.3.2-2 if the NR PSCell is in the same band as the deactivated SCell.

Table A.4.5.2.3.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	1
1	0.5	1

Table A.4.5.2.3.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	1 + SMTC duration
1	0.5	1 + SMTC duration

Each interruption on E-UTRAN PCell shall not exceed 1ms + SMTC duration subframes for intraband EN-DC, 1 subframe for synchronous interband EN-DC.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.4 E-UTRAN – NR FR1 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

A.4.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in TS 38.133 clause 8.2.1. Supported test configurations are shown in table A.4.5.2.4.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.4.1-2 and A.4.5.2.4.1-3 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell1, Cell2 and Cell3. Cell1 is LTE PCell, Cell2 and Cell3 is NR PSCell and NR deactivated SCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.4.5.2.4.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.4.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 3.
CP length		Normal	Applicable to Cell1, Cell2 and Cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.4.5.2.4.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter		Unit	Cell2	Cell3
Frequency Range			**FR1**	**FR1**
Duplex mode	Config 1,4		FDD	FDD
	Config 2,3,5,6		TDD	TDD
TDD configuration	Config 1,4		Not Applicable	Not Applicable
	Config 2,5		TDDConf.1.1	TDDConf.1.1
	Config 3,6		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	Config 1,4		10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1,4		DLBWP.0.1	DLBWP.0.1
	Config 2,5		DLBWP.0.1	DLBWP.0.1
	Config 3,6		DLBWP.0.1	DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1	DLBWP.1.1
	Config 2,5		DLBWP.1.1	DLBWP.1.1
	Config 3,6		DLBWP.1.1	DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1	ULBWP.0.1
	Config 2,5		ULBWP.0.1	ULBWP.0.1
	Config 3,6		ULBWP.0.1	ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1	ULBWP.1.1
	Config 2,5		ULBWP.1.1	ULBWP.1.1
	Config 3,6		ULBWP.1.1	ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD	-
	Config 3,6		SR.2.1 TDD	-
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD	CR.1.1 FDD
	Config 2,5		CR.1.1 TDD	CR.1.1 TDD
	Config 3,6		CR.2.1 TDD	CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD	CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD	CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD	CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD	TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD	TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD	TRS.1.2 TDD
OCNG Patterns			OP.1	OP.1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1	SSB.1 FR1
	Config 3,6		SSB.2 FR1	SSB.2 FR1
SMTC Configuration			SMTC.1	SMTC.1
TCI state			TCI.State.0	TCI.State.0
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		dBm/15 kHz	-104	-104
SS-RSRP Note 3		dBm/15 kHz	-87	-87
$\hat{E}_s/I_{ot}$		dB	17	17
$\hat{E}_s/N_{oc}$		dB	17	17
Io Note3	Config 1,2,4,5	dBm/9.36MHz	-58.96	-58.96
	Config 3,6	dBm/38.16MHz	-52.86	-52.86
Time offset to Cell1 Note 4		ms	3	3
Time offset to Cell2 Note 5		µs	-	3
Propagation Condition			AWGN	AWGN

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4:	Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells
Note 5:	Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.4.5.2.4.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.4.5.2.4.2-1 and Table A.4.5.2.4.2-2.

Table A.4.5.2.4.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	1
1	0.5	1

Table A.4.5.2.4.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	1 + SMTC duration
1	0.5	1 + SMTC duration

Each interruption on E-UTRAN PCell shall not exceed 1ms + SMTC duration subframes for synchronous intraband EN-DC, or 2 subframes for asynchronous interband EN-DC.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.5 E-UTRAN – NR FR1 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

A.4.5.2.5.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in TS38.133 clause 8. 2.1.2. Supported test configurations are shown in table A.4.5.2.5.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.5.1-2 and A.4.5.2.5.1-3 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell1, Cell2 and Cell3. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR1 PSCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRAN SCells is received at the UE antenna connector, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.4.5.2.5.1-1: Interruptions during measurements on deactivated E-UTRAN SCC supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.5.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and the other two are E-UTRAN RF channels
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Active PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to Cell1, Cell2 and Cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.4.5.2.5.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter		**Unit**	**Cell2**
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36MHz	-58.96
	Config 3,6	dBm/38.16MHz	-52.86
Time offset to Cell1 Note 4		µs	33
Propagation Condition			AWGN

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4:	Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells

A.4.5.2.5.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed X defined in Table A.4.5.2.5.2-1 if the NR PSCell is not in the same band as the E-UTRAN deactivated SCell or Y in Table A.4.5.2.3.2-1 if the NR PSCell is in the same band as the E-UTRAN deactivated SCell.

Table A.4.5.2.5.2-1: Interruption length X and Y at measurements on deactivated E-UTRA SCC

μ	NR Slot length (ms)	Interruption length X slot	Interruption length Y slot
		Sync	
0	1	1	1
1	0.5	1	1

Each interruption on E-UTRAN PCell shall not exceed 1 subframe if the PCell is not in the same band as the deactivated SCell, or 5 subframes if the PCell is in the same band as the deactivated SCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.6 E-UTRAN – NR FR1 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

A.4.5.2.6.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in TS 38.133 clause 8.2.1. Supported test configurations are shown in table A.4.5.2.6.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.4.5.2.6.1-1 and A.4.5.2.6.1-2 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-1. In the test there are three cells: Cell1, Cell2 and Cell3. Cell1 and Cell3 is E-UTRAN PCell and E-UTRAN deactivated SCell, Cell2 is NR FR1 PSCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.4.5.2.6.1-1: Interruptions during measurements on deactivated E-UTRAN SCC supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.2.6.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and the other two are E-UTRAN RF channels
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to Cell1, Cell2 and Cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.4.5.2.6.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

Parameter		Unit	Cell2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.2.1
$BW_{channel}$	Config 1,4		10: $N_{RB,c}$ = 52
	Config 2,5		10: $N_{RB,c}$ = 52
	Config 3,6		40: $N_{RB,c}$ = 106
Initial DL BWP Configuration	Config 1,4		DLBWP.0.1
	Config 2,5		DLBWP.0.1
	Config 3,6		DLBWP.0.1
Dedicated DL BWP Configuration	Config 1,4		DLBWP.1.1
	Config 2,5		DLBWP.1.1
	Config 3,6		DLBWP.1.1
Initial UL BWP Configuration	Config 1,4		ULBWP.0.1
	Config 2,5		ULBWP.0.1
	Config 3,6		ULBWP.0.1
Dedicated UL BWP Configuration	Config 1,4		ULBWP.1.1
	Config 2,5		ULBWP.1.1
	Config 3,6		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
PDCCH CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
TRS configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
TCI state			TCI.State.0
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36MHz	-58.96
	Config 3,6	dBm/38.16MHz	-52.86
Time offset to Cell1 Note 4		µs	500
Propagation Condition			AWGN

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4:	Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell at the UE antenna connector including time alignment error between the two cells

A.4.5.2.6.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on E-UTRAN PCell and NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.4.5.2.4.2-1 and Table A.4.5.2.4.2-2.

Table A.4.5.2.6.2-1: Interruption duration if the NR PSCell is not in the same band as the E-UTRAN deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	2
1	0.5	2

Table A.4.5.2.6.2-2: Interruption duration if the NR PSCell is in the same band as the E-UTRAN deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	2 + SMTC duration
1	0.5	2 + SMTC duration

Each interruption on E-UTRAN PCell shall not exceed 1 subframe if the PCell is not in the same band as the deactivated SCell, or 5 subframes if the PCell is in the same band as the deactivated SCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.2.7 Void

A.4.5.3 SCell Activation and Deactivation Delay

A.4.5.3.1 SCell Activation and deactivation of known SCell in FR1 for 160ms SCell measurement cycle

A.4.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations are shown in table A.4.5.3.1.1-1 below. The test parameters are given in Tables A.4.5.3.1.1-2 and cell-specific parameters in A.4.5.3.1.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. All cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRA and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. The UE now starts monitoring the SCell. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in a slot # denoted m, defines the start of time period T2. The UE shall be able to report valid CSI in PSCell for the activated SCell at latest in slot $\mathrm{m} + \frac{T_{\mathrm{HARQ}}+T_{\mathrm{activation\_time}}+T_{\mathrm{CSI\_Reporting}}}{\mathrm{NR\ slot\ length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PSCell in slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to slot $m + 1 + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe $m_1 + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{EUTRA\ slot\ length}}$ to subframe $m_2 + 1 + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+T_{\mathrm{X}}}{\mathrm{EUTRA\ slot\ length}} + N_{\mathrm{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\mathrm{interruption}}$ is the interruption length given in TS 36.133 [14] clause 7.32.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot $\mathrm{n} + \frac{\mathrm{T}_{\mathrm{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3. The starting point of any PSCell interruption due to the deactivation shall occur in the slot $\mathrm{n} + 1 + \frac{\mathrm{T}_{\mathrm{HARQ}}}{NR\ slot\ length}$ to $\mathrm{n} + 1 + \frac{\mathrm{T}_{\mathrm{HARQ}}+3\mathrm{ms}}{NR\ slot\ length}$, as defined in clause 8.3. The starting point of any E-UTRA PCell interruption due to the deactivation shall occur in the subframe $n_1 + 1 + \frac{T_{\mathrm{HARQ}}}{EUTRA\ subframe\ length}$ to subframe $\mathrm{n}_2 + 1 + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}}{EUTRA\ subframe\ length}$, where n_1 and n_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PSCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CSI reporting for SCell is discontinued.

Table A.4.5.3.1.1-1: known FR1 SCell activation in non-DRX for 160ms SCell measurement cycle supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.3.1.1-2: General test parameters for known FR1 SCell activation case, 160ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2,3	One E-UTRAN radio channel (1) and two NR radio channel (2,3) are used for this test
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.1
Active PSCell		Cell 2	Primary secondary cell on NR RF channel number 2.
Configured deactivated SCell		Cell 3	Configured deactivated secondary cell on NR RF channel number 3
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every four slots.
Cell-individual offset for cells on E-UTRA RF channel number	dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on secondary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell3 timing offset to cell2	µs	0	
Time alignment error between cell3 and cell2	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PSCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1NR slot length	k_1 is a number of slots indicated by the PDSCH-to-HARQ_feedback timing indicator field in a corresponding DCI format or provided by *dl-DataToUL-ACK* if the PDSCH-to-HARQ feedback timing field is not present in the DCI format, the value is defined in 38.213 [3]
$T_{CSI\_Reporting}$	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]
k	ms	$k_1 + 3 \cdot N_{slot}^{subframe,\ \mu} + 1$	As specified in clause 4.3 of TS 38.213 [3]

Table A. 4.5.3.1.1-3: Cell specific test parameters for known FR1 SCell activation case, 160ms SCell measurement cycle

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			**freq1**			**freq2**		
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52					
	Config 2,5		10: $N_{RB,c}$ = 52					
	Config 3,6		40: $N_{RB,c}$ = 106					
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1					
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1					
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1					
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1					
DRx Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD			SR.1.1 FDD		
	Config 2,5		SR.1.1 TDD			SR.1.1 TDD		
	Config 3,6		SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD			CR.1.1 FDD		
	Config 2,5		CR.1.1 TDD			CR.1.1 TDD		
	Config 3,6		CR.2.1 TDD			CR.2.1 TDD		
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD			CCR.1.1 FDD		
	Config 2,5		CCR.1.1 TDD			CCR.1.1 TDD		
	Config 3,6		CCR.2.1 TDD			CCR.2.1 TDD		
TRS configuration	Config 1,4		TRS.1.1 FDD			TRS.1.1 FDD		
	Config 2,5		TRS.1.1 TDD			TRS.1.1 TDD		
	Config 3,6		TRS.1.2 TDD			TRS.1.2 TDD		
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
SSB configuration	Config 1,2,4,5		SSB.1 FR1					
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz					
	Config 3,6		30kHz					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15kHz	-104					
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-104					
	Config 3,6		-101					
$\hat{E}_s/I_{ot}$		dB	17					
$\hat{E}_s/N_{oc}$		dB	17					

SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87
	Config 3,6		-84
SCH_RP Note 3		dBm/15 kHz	-87
Propagation condition		-	AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]			

A.4.5.3.1.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption. Whether CSI report in slot (m+k) was interrupted is checked by monitoring ACK/NACK sent in PCell in slot (m+k).

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $\mathrm{m} + \frac{\mathrm{T_{HARQ}} + T_{\mathrm{activtion\_time}} + T_{\mathrm{CSI\_Reporting}}}{NR\ slot\ length}$, $\mathrm{T_{activation\_time}} = \mathrm{T_{FirstSSB}} +$ 5ms, as defined in clause 8.3.

During T3 the UE shall stop sending CSI reports for SCell at latest in a slot $\mathrm{n} + \frac{\mathrm{T_{HARQ}} + 3\mathrm{ms}}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $m + 1 + \frac{T_{\mathrm{HARQ}} + 3\mathrm{ms} + T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, and interruption of E-UTRA PCell during SCell activation shall not happen outside the subframe $m_1 + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{EUTRA\ slot\ length}}$ to subframe $m_2 + 1 + \frac{T_{\mathrm{HARQ}} + 3\mathrm{ms} + T_{\mathrm{X}}}{\mathrm{EUTRA\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3.

During T3 the starting point of interruption of PSCell during SCell deactivation shall not happen outside the slot $\mathrm{n} + 1 + \frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to $\mathrm{n} + 1 + \frac{\mathrm{T_{HARQ}} + 3\mathrm{ms}}{NR\ slot\ length}$, as defined in clause 8.3 and the starting point of interruption of E-UTRA PCell during SCell deactivation shall not happen outside the subframe $n_1 + 1 + \frac{T_{\mathrm{HARQ}}}{EUTRA\ subframe\ length}$ to subframe $\mathrm{n}_2 + 1 + \frac{T_{\mathrm{HARQ}} + 3\mathrm{ms}}{EUTRA\ subframe\ length}$.

The interruption of PSCell shall not be more than the values specified for EN-DC in Clause 8.2.1.2.4.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90%.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\mathrm{m} + \frac{\mathrm{T_{HARQ}} + T_{\mathrm{activtion\_time}} + T_{\mathrm{CSI\_Reporting}}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.4.5.3.2 SCell Activation and deactivation of known SCell in FR1 for 320 ms SCell measurement cycle

A.4.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.4.5.3.1.1. The supported test configurations are the same as defined in clause A.4.5.3.1.1. The test parameters are the same except those described in the following clause. The listed parameter values in Tables A.4.5.3.2.1-1 will replace the values of corresponding parameters in Tables A.4.5.3.1.1-2.

Table A.4.5.3.2.1-1: General test parameters for known FR1 SCell activation case, 320 ms SCell measurement cycle

Parameter	Unit	Value	Comment
SCell measurement cycle (measCycleSCell)	ms	320	

A.4.5.3.2.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value $T_{FirstSSB\_MAX}$ + T_{rs} + 5ms.

A.4.5.3.3 SCell Activation and deactivation of unknown SCell in FR1

A.4.5.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is unknown by the UE at the time of activation.

The supported test configurations are the same as defined in clause A.4.5.3.1.1. The test parameters are the same except those described in the following clause. The listed parameter values in Tables A.4.5.3.3.1-1 will replace the values of corresponding parameters in Tables A.4.5.3.1.1-2. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell, NR has two cells. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. Immediately at beginning of T2 the transmission power of cell 3 is increased to same level as for cell 2. The UE shall be able to report valid CSI for the activated SCell at latest in slot $\mathrm{m} + \frac{\mathrm{T_{HARQ}} + T_{\mathrm{activtion\_time}} + T_{\mathrm{CSI\_Reporting}}}{NR\ slot\ length}$ as defined in clause 8.3 provided the SCell can be successfully detected on the first attempt. The UE shall start reporting CSI in slot (m+k) and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PSCell interruption due to activation of SCell shall occur in the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to slot $m + 1 + \frac{T_{\mathrm{HARQ}} + 3\mathrm{ms} + T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2. Any E-UTRA PCell interruption due to activation of SCell shall occur in the subframe $m_1 + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{EUTRA\ slot\ length}}$ to subframe $m_2 + 1 + \frac{T_{\mathrm{HARQ}} + 3\mathrm{ms} + T_{\mathrm{X}}}{\mathrm{EUTRA\ slot\ length}} + N_{\mathrm{interruption}}$, where m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m, and $N_{\mathrm{interruption}}$ is the interruption length given in TS 36.133 [14] clause 7.32.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell at latest in slot $\mathrm{n}+\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$ as defined in clause 8.3. The starting point of any PSCell interruption due to the deactivation shall occur in the slot $\mathrm{n}+1+\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to $\mathrm{n}+1+\frac{\mathrm{T_{HARQ}}+3\mathrm{ms}}{NR\ slot\ length}$, as defined in clause 8.3. The starting point of any E-UTRA PCell interruption due to the deactivation shall occur in the subframe $n_1+1+\frac{T_{\mathrm{HARQ}}}{EUTRA\ subframe\ length}$ to subframe $\mathrm{n}_2+1+\frac{T_{\mathrm{HARQ}}+3\mathrm{ms}}{EUTRA\ subframe\ length}$, where n_1 and n_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell1 deactivation command is sent until CSI reporting for SCell1 is discontinued.

Table A.4.5.3.3.1-1: General test parameters for unknown FR1 SCell activation case, 160ms SCell measurement cycle

Parameter	Unit	Value	Comment
T1	ms	100	During this time the PSCell shall be known and the SCell configured, but not detected.

A.4.5.3.3.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value $T_{FirstSSB\_MAX}$ + T_{SMTC_MAX} + 2*T_{rs} + 5ms as defined in clause 8.3.

A.4.5.4 UE UL carrier RRC reconfiguration Delay

A.4.5.4.1 UE UL carrier RRC reconfiguration Delay

Table A.4.5.4.1-1 - Table A.4.5.4.1-4 : Void

A.4.5.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that when the UE receives a RRC message implying NR UL or Supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within the time limits specified in clause 8.4.2 and 8.4.3 for configuring and deconfiguring, respectively.

There are three cells: E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and FR1 SCell (Cell 3). For SCell, both NR uplink and supplementary uplink are broadcast by *ServingCellConfigCommonSIB.* The test parameters for PSCell and SCell are given in Table A. 4.5.4.1.1-1, Table A. 4.5.4.1.1-2, Table A. 4.5.4.1.1-3 and Table A. 4.5.4.1.1-4 below. The test parameters and applicability for E-UTRAN PCell are defined in A.3.7.2. The test consists two tests. In test 1, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, NR uplink of cell 3 is configured to UE. At the start of T2, a supplementary uplink of cell3 is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the supplementary uplink is released through *RRCReconfiguration*.

In test 2, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, supplementray uplink on cell 3 is configured to UE. At the start of T2, a NR uplink is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the NR uplink is released through *RRCReconfiguration*.

Table A.4.5.4.1.1-1: Supported test configurations

Configuration	**PSCell (Cell2)**	**SCell (Cell3)**
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	DL and UL: 15kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; SUL: 15kHz SCS, 10 MHz bandwidth, SUL duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	DL and UL: 15kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode; SUL: 15kHz SCS, 10 MHz bandwidth, SUL duplex mode
3	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	DL and UL: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; SUL: 30kHz SCS, 40 MHz bandwidth, SUL duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	DL and UL: 15kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; SUL: 15kHz SCS, 10 MHz bandwidth, SUL duplex mode
5	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	DL and UL: 15kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode; SUL: 15kHz SCS, 10 MHz bandwidth, SUL duplex mode
6	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	DL and UL: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; SUL: 30kHz SCS, 40 MHz bandwidth, SUL duplex mode
7	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	DL and UL: 15kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; SUL: 15kHz SCS, 10 MHz bandwidth, SUL duplex mode
8	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	DL and UL: 15kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode; SUL: 15kHz SCS, 10 MHz bandwidth, SUL duplex mode
9	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	DL and UL: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; SUL: 30kHz SCS, 40 MHz bandwidth, SUL duplex mode
Note: The UE is only required to be tested in one of the supported test configurations		

Table A.4.5.4.1.1-2: General test parameters for EN-DC UE UL carrier RRC reconfiguration Delay

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1,2,3, 4, 5, 6, 7, 8, 9	1, 2, 3	Three radio channels are used for these two tests.
Active cell		Config 1,2,3, 4, 5, 6, 7, 8, 9	Cell 1: E-UTRAN PCell Cell 2: FR1 PSCell Cell 3: FR1 SCell	E-UTRAN PCell on RF channel number 1 FR1 PSCell on RF channel number 2 FR1 SCell on RF channel number 3
CP length		Config 1,2,3, 4, 5, 6, 7, 8, 9	Normal	
DRX		Config 1,2,3, 4, 5, 6, 7, 8, 9	OFF	
Measurement gap pattern Id		Config 1,2,3, 4, 5, 6, 7, 8, 9	OFF	
Filter coefficient		Config 1,2,3, 4, 5, 6, 7, 8, 9	0	L3 filtering is not used
T1	s	Config 1,2,3, 4, 5, 6, 7, 8, 9	5	
T2	s	Config 1,2,3, 4, 5, 6, 7, 8, 9	5	
T3	s	Config 1,2,3, 4, 5, 6, 7, 8, 9	5	

Table A.4.5.4.1.1-3: NR Cell specific test parameters for EN-DC UE UL carrier RRC reconfiguration Delay on PSCell (Cell 2)

Parameter	Unit	Test Configuration	Test 1			Test 2		
			T1	T2	T3	T1	T2	T3

Channel number		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	2	2
TDD configuration		Conf 1, 2, 3	N/A	N/A
		Conf 4, 5, 6	TDD Conf.1.1	TDD Conf.1.1
		Conf 7, 8, 9	TDD Conf.2.1	TDD Conf.2.1
$BW_{channel}$	MHz	Conf 1, 2, 3	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
		Conf 4, 5, 6	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
		Conf 7, 8, 9	40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
PDSCH reference measurement channel as defined in A.3.1.1		Conf 1, 2, 3	SR.1.1 FDD	SR.1.1 FDD
		Conf 4, 5, 6	SR.1.1 TDD	SR.1.1 TDD
		Conf 7, 8, 9	SR 2.1 TDD	SR 2.1 TDD
RMSI CORESET reference measurement channel as defined in A.3.1.2		Conf 1, 2, 3	CR.1.1 FDD	CR.1.1 FDD
		Conf 4, 5, 6	CR.1.1 TDD	CR.1.1 TDD
		Conf 7, 8, 9	CR.2.1 TDD	CR.2.1 TDD
RMC CORESET reference measurement channel as defined in A.3.1.3		Conf 1, 2, 3	CCR.1.1 FDD	CCR.1.1 FDD
		Conf 4, 5, 6	CCR.1.1 TDD	CCR.1.1 TDD
		Conf 7, 8, 9	CCR.2.1 TDD	CCR.2.1 TDD
OCNG Pattern Note 1		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	OP.1	OP.1
SSB configuration		Conf 1, 2, 3, 4, 5, 6	SSB.1 FR1	SSB.1 FR1
		Conf 7, 8, 9	SSB.2 FR1	SSB.2 FR1
SMTC configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	SMTC.1	SMTC.1
DL initial BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	ULBWP.1.1	ULBWP.1.1
EPRE ratio of PSS to SSS	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	0	0
EPRE ratio of PBCH_DMRS to SSS				
EPRE ratio of PBCH to PBCH_DMRS				
EPRE ratio of PDCCH_DMRS to SSS				
EPRE ratio of PDCCH to PDCCH_DMRS				
EPRE ratio of PDSCH_DMRS to SSS				
EPRE ratio of PDSCH to PDSCH_DMRS				
EPRE ratio of OCNG DMRS to SSS				
EPRE ratio of OCNG to OCNG DMRS				

N_{oc} Note 2	dBm / 15kHz	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	-102			-102		
	dBm/ SCS	Conf 1,2,3,4,5,6	-102			-102		
		Conf 7,8,9	-99			-99		
$\hat{E}_s/N_{oc}$	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16
$\hat{E}_s/I_{ot}$ Note 3	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16
SS-RSRP Note 3	dBm/ SCS	Conf 1,2,3,4,5,6	-86	-86	-86	-86	-86	-86
		Conf 7,8,9	-83	-83	-83	-83	-83	-83
Io Note 3	dBm/ 9.36 MHz	Conf 1,2,3,4,5,6	-57.9	-57.9	-57.9	-57.9	-57.9	-57.9
	dBm/ 38.16 MHz	Conf 7,8,9	-51.8	-51.8	-51.8	-51.8	-51.8	-51.8
Propagation Condition		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	AWGN			AWGN		
Antenna configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	1 x 2			1 x 2		
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: $\hat{E}_s/I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

Table A.4.5.4.1.1-4: NR Cell specific test parameters for EN-DC UE UL carrier RRC reconfiguration Delay on SCell (Cell 3)

Parameter	Unit	Test Configuration	Test 1			Test 2		
			T1	T2	T3	T1	T2	T3
Channel number		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	3			3		
TDD configuration		Conf 1, 4, 7	N/A			N/A		
		Conf 2, 5, 8	TDDConf.1.1			TDDConf.1.1		
		Conf 3, 6, 9	TDDConf.2.1			TDDConf.2.1		
$BW_{channel}$	MHz	Conf 1, 4, 7	10: $N_{RB,c}$ = 52			10: $N_{RB,c}$ = 52		
		Conf 2, 5, 8	10: $N_{RB,c}$ = 52			10: $N_{RB,c}$ = 52		
		Conf 3, 6, 9	40: $N_{RB,c}$ = 106			40: $N_{RB,c}$ = 106		
PUSCH parameters for NR UL carrier		Conf 1, 4, 7	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	N/A	G-FR1-A3-10 in [13]	N/A
		Conf 2, 5, 8	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	N/A	G-FR1-A3-10 in [13]	N/A
		Conf 3, 6, 9	G-FR1-A3-14 in [13]	G-FR1-A3-14 in [13]	G-FR1-A3-14 in [13]	N/A	G-FR1-A3-14 in [13]	N/A
PUCCH parameters For NR UL carrier		Conf 1, 4, 7	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	N/A	N/A	N/A
		Conf 2, 5, 8	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	N/A	N/A	N/A
		Conf 3, 6, 9	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]	N/A	N/A	N/A
PUSCH parameters for supplementary UL		Conf 1, 4, 7	N/A	G-FR1-A3-10 in [13]	N/A	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]
		Conf 2, 5, 8	N/A	G-FR1-A3-10 in [13]	N/A	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]
		Conf 3, 6, 9	N/A	G-FR1-A3-14 in [13]	N/A	G-FR1-A3-14 in [13]	G-FR1-A3-14 in [13]	G-FR1-A3-14 in [13]
PUCCH parameters for supplementary UL		Conf 1, 4, 7	N/A	N/A	N/A	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]
		Conf 2, 5, 8	N/A	N/A	N/A	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]
		Conf 3, 6, 9	N/A	N/A	N/A	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]
PDSCH reference measurement channel as defined in A.3.1.1		Conf 1, 4, 7	SR.1.1 FDD			SR.1.1 FDD		
		Conf 2, 5, 8	SR.1.1 TDD			SR.1.1 TDD		
		Conf 3, 6, 9	SR 2.1 TDD			SR 2.1 TDD		
RMSI CORESET reference		Conf 1, 4, 7	CR.1.1 FDD			CR.1.1 FDD		
		Conf 2, 5, 8	CR.1.1 TDD			CR.1.1 TDD		

measurement channel as defined in A.3.1.2		Conf 3, 6, 9	CR.2.1 TDD			CR.2.1 TDD		
RMC CORESET reference measurement channel as defined in A.3.1.3		Conf 1, 4, 7	CCR.1.1 FDD			CCR.1.1 FDD		
		Conf 2, 5, 8	CCR.1.1 TDD			CCR.1.1 TDD		
		Conf 3, 6, 9	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern Note 1		Conf 1, 2, 3	OP.1			OP.1		
SSB configuration		Conf 1, 2, 4, 5, 7,8	SSB.1 FR1			SSB.1 FR1		
		Conf 3, 6, 9	SSB.2 FR1			SSB.2 FR1		
SMTC configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	SMTC.1			SMTC.1		
DL initial BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.0.1			DLBWP.0.1		
DL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.1.1			DLBWP.1.1		
UL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	ULBWP.1.1			ULBWP.1.1		
EPRE ratio of PSS to SSS	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	0			0		
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS								
EPRE ratio of OCNG to OCNG DMRS								
N_{oc} Note 2	dBm / 15kHz	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	-102			-102		
	dBm/ SCS	Conf 1, 2, 4, 5, 7,8	-102			-102		
		Conf 3, 6, 9	-99			-99		
$\hat{E}_s/N_{oc}$	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16
$\hat{E}_s/I_{ot}$ Note 3	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16
SS-RSRP Note 3	dBm/ SCS	Conf 1, 2, 4, 5, 7,8	-86	-86	-86	-86	-86	-86
		Conf 3, 6, 9	-83	-83	-83	-83	-83	-83
Io Note 3	dBm/ 9.36 MHz	Conf 1, 2, 4, 5, 7,8	-57.9	-57.9	-57.9	-57.9	-57.9	-57.9

	dBm/ 38.16 MHz	Conf 3, 6, 9	-51.8	-51.8	-51.8	-51.8	-51.8	-51.8
Propagation Condition		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	AWGN			AWGN		
Antenna configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	1 x 2			1 x 2		
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: $\hat{E}_s/I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.4.5.4.1.2 Test Requirements

In test 1 the UE shall be ready to start transmission on the supplementary uplink carrier on SCell within 20ms from the start of T2.

In test 1 the UE shall stop the transmission on the supplementary uplink carrier on SCell within 20ms from the start of T3.

In test 2 the UE shall be ready to start transmission on the NR uplink carrier on SCell within 20ms from the start of T2.

In test 2 the UE shall stop the transmission on the NR uplink carrier on SCell within 20ms from the start of T3.

All of the above test requirements shall be fulfilled in order for the observed UE UL carrier configuration delay and UE UL carrier release delay to be counted as correct. The rate of correct observed UE UL carrier configuration delay and UE UL carrier release delay during repeated tests shall be at least 90%.

A.4.5.5 Beam Failure Detection and Link recovery procedures

A.4.5.5.1 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in non-DRX mode

A.4.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.1.1-1, A.4.5.5.1.1-2, A.4.5.5.1.1-3 and A.4.5.5.1.1-4 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.1.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.4.5.5.1.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 1.

Table A.4.5.5.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.1.1-2: General test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value Test 1	Comment
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BWchannel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB.3 FR1	
	Config 2, 5		SSB.3 FR1	
	Config 3, 6		SSB.4 FR1	
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1	
	Config 3, 6		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz	
	Config 3, 6		30 KHz	
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.2-1	
	Config 3, 6		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	

	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2, 4, 5	dBm/SCS kHz	-98	Threshold used for $Q_{in\_LR\_SSB}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
SSB Index assigned as RLM RS			0,1	
T310 timer		ms	1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.37	
T3		s	0.24	
T4		s	0	
T5		s	0.17	
D1		s	0.13	
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: E-UTRAN is in non-DRX mode under test.				

Table A.4.5.5.1.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1, 4	dB	5	-3	-12	-12	-12
	Config 2, 5		5	-3	-12	-12	-12
	Config 3, 6		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10
SSB_RP of set q_1	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.4.5.5.1.1-4: Void

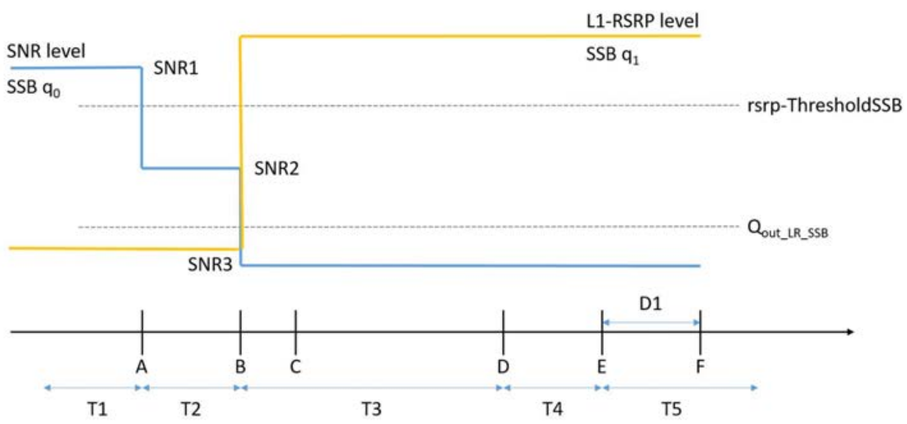


Figure A.4.5.5.1.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.4.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.2 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with SSB-based BFD and LR in DRX mode

A.4.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.2.1-1, A.4.5.5.2.1-2, A.4.5.5.2.1-3, A.4.5.5.2.1-4 and A.4.5.5.2.1-5 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.2.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.4.5.5.2.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.4.5.5.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.2.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
BWchannel	Config 1, 4	MHz	10: NRB,c = 52	
	Config 2, 5		10: NRB,c = 52	
	Config 3, 6		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3, 4, 5, 6		ULBWP.1.1	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB.3 FR1	
	Config 2, 5		SSB.3 FR1	
	Config 3, 6		SSB.4 FR1	
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1	
	Config 3, 6		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz	
	Config 3, 6		30 KHz	
PRACH Configuration	Config 1, 2, 4, 5		Table A.3.8.2.2-1	
	Config 3, 6		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	

	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2, 4, 5	dBm/SCS kHz	-98	Threshold used for $Q_{in\_LR\_SSB}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
SSB Index assigned as RLM RS			0,1	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	5.17	
T3		s	3.24	
T4		s	0	
T5		s	1.97	
D1		s	1.93	
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: E-UTRAN is in non-DRX mode under test.				

Table A.4.5.5.2.1-3: Cell specific test parameters for FR1 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	**T2**	**T3**	**T4**	**T5**
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1, 4	dB	5	-3	-12	-12	-12
	Config 2, 5		5	-3	-12	-12	-12
	Config 3, 6		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10
SSB_RP of set q_1	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.4.5.5.2.1-4: Void

Table A.4.5.5.2.1-5: Void

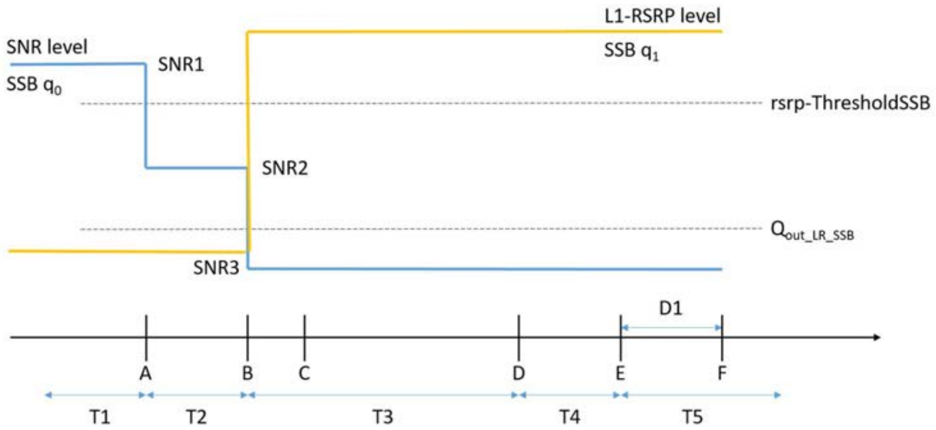


Figure A.4.5.5.2.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.4.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.3 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.4.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.3.1-1, A.4.5.5.3.1-2, and A.4.5.5.3.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.3.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the CSI-RS in set q_0 in the active PSCell to emulate CSI-RS based beam failure.

Figure A.4.5.5.3.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is not enabled.

Table A.4.5.5.3.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.3.1-2: General test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

<table>
<tr><th colspan="2" rowspan="2">Parameter</th><th rowspan="2">Unit</th><th>Value</th><th rowspan="2">Comment</th></tr>
<tr><th>Test 1</th></tr>
<tr><td colspan="2">Active PCell</td><td></td><td>Cell 1</td><td></td></tr>
<tr><td colspan="2">RF Channel Number</td><td></td><td>1</td><td></td></tr>
<tr><td colspan="2">Active PSCell</td><td></td><td>Cell 2</td><td></td></tr>
<tr><td colspan="2">RF Channel Number</td><td></td><td>2</td><td></td></tr>
<tr><td rowspan="2">Duplex mode</td><td>Config 1, 4</td><td rowspan="2"></td><td>FDD</td><td></td></tr>
<tr><td>Config 2, 3, 5, 6</td><td>TDD</td><td></td></tr>
<tr><td rowspan="3">TDD Configuration</td><td>Config 1, 4</td><td rowspan="3"></td><td>Not Applicable</td><td></td></tr>
<tr><td>Config 2, 5</td><td>TDDConf.1.1</td><td></td></tr>
<tr><td>Config 3, 6</td><td>TDDConf.2.1</td><td></td></tr>
<tr><td rowspan="3">CORESET Reference Channel</td><td>Config 1, 4</td><td rowspan="3"></td><td>CR.1.1 FDD</td><td rowspan="3">A.3.1.2</td></tr>
<tr><td>Config 2, 5</td><td>CR.1.1 TDD</td></tr>
<tr><td>Config 3, 6</td><td>CR.2.1 TDD</td></tr>
<tr><td rowspan="3">SSB Configuration</td><td>Config 1, 4</td><td rowspan="3"></td><td>SSB.1 FR1</td><td rowspan="3">A.3.10</td></tr>
<tr><td>Config 2, 5</td><td>SSB.1 FR1</td></tr>
<tr><td>Config 3, 6</td><td>SSB.2 FR1</td></tr>
<tr><td rowspan="2">SMTC Configuration</td><td>Config 1, 2, 4, 5</td><td rowspan="2"></td><td>SMTC.1</td><td rowspan="2">A.3.11</td></tr>
<tr><td>Config 3, 6</td><td>SMTC.1</td></tr>
<tr><td rowspan="2">PDSCH/PDCCH subcarrier spacing</td><td>Config 1, 2, 4, 5</td><td rowspan="2"></td><td>15 KHz</td><td></td></tr>
<tr><td>Config 3, 6</td><td>30 KHz</td><td></td></tr>
<tr><td colspan="2">csi-RS-Index assigned as beam failure detection RS in set q_0</td><td></td><td>0</td><td></td></tr>
<tr><td colspan="2">OCNG parameters</td><td></td><td>OP.1</td><td>A.3.2.1</td></tr>
<tr><td colspan="2">CP length</td><td></td><td>Normal</td><td></td></tr>
<tr><td colspan="2">Correlation Matrix and Antenna Configuration</td><td></td><td>2x2 Low</td><td></td></tr>
<tr><td rowspan="7">Beam failure detection transmission parameters</td><td>DCI format</td><td></td><td>1-0</td><td></td></tr>
<tr><td>Number of Control OFDM symbols</td><td></td><td>2</td><td></td></tr>
<tr><td>Aggregation level</td><td>CCE</td><td>8</td><td></td></tr>
<tr><td>Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy</td><td>dB</td><td>0</td><td></td></tr>
<tr><td>Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy</td><td>dB</td><td>0</td><td></td></tr>
<tr><td>DMRS precoder granularity</td><td></td><td>REG bundle size</td><td></td></tr>
<tr><td>REG bundle size</td><td></td><td>6</td><td></td></tr>
<tr><td colspan="2">DRX</td><td></td><td>OFF</td><td></td></tr>
<tr><td colspan="2">Gap pattern ID</td><td></td><td>N.A.</td><td></td></tr>
<tr><td colspan="2">csi-RS-Index assigned as candidate beam detection RS in set q_1</td><td></td><td>1</td><td></td></tr>
<tr><td colspan="2">rlmInSyncOutOfSyncThreshold</td><td></td><td>absent</td><td>When the field is absent, the UE applies the value 0. (Table 8.1.1-1).</td></tr>
<tr><td rowspan="2">rsrp-ThresholdSSB</td><td>Config 1, 2, 4, 5</td><td rowspan="2">dBm/SCS kHz</td><td>-98</td><td rowspan="2">Threshold used for $Q_{in\_LR\_SSB}$</td></tr>
<tr><td>Config 3, 6</td><td>-95</td></tr>
</table>

powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for q_0 and q_1	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	A.3.14
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
TRS configuration	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
csi-RS-Index assigned as RLM RS	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.18	
T3		s	0.14	
T4		s	0	
T5		s	0.08	
D1		s	0.04	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.4.5.5.3.1-3: Cell specific test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1, 4	dB	5	-3	-12	-12	-12
	Config 2, 5		5	-3	-12	-12	-12
	Config 3, 6		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

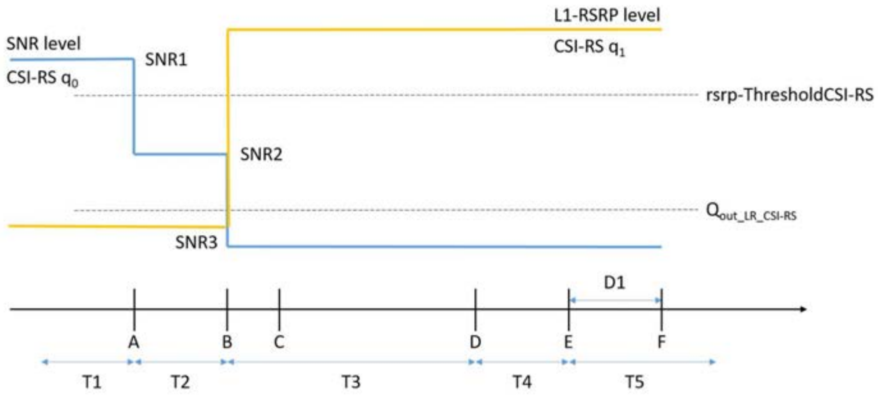


Figure A.4.5.5.3.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

A.4.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 30+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.5.4 EN-DC Beam Failure Detection and Link Recovery Test for FR1 PSCell configured with CSI-RS-based BFD and LR in DRX mode

A.4.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.4.5.5.4.1-1, A.4.5.5.4.1-2, A.4.5.5.4.1-3, and A.4.5.5.4.1-4 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.4.5.5.4.1-1 shows the variation of the downlink SNR of the PSCell and the SNR of the CSI-RS in set q_0 in the active PSCell to emulate CSI-RS based beam failure. Figure A.4.5.5.4.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e.

UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.4.5.5.4.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.5.4.1-2: General test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1, 4		FDD	
	Config 2, 3, 5, 6		TDD	
TDD Configuration	Config 1, 4		Not Applicable	
	Config 2, 5		TDDConf.1.1	
	Config 3, 6		TDDConf.2.1	
CORESET Reference Channel	Config 1, 4		CR.1.1 FDD	A.3.1.2
	Config 2, 5		CR.1.1 TDD	
	Config 3, 6		CR.2.1 TDD	
SSB Configuration	Config 1, 4		SSB.1 FR1	A.3.10
	Config 2, 5		SSB.1 FR1	
	Config 3, 6		SSB.2 FR1	
SMTC Configuration	Config 1, 2, 4, 5		SMTC.1	A.3.11
	Config 3, 6		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2, 4, 5		15 KHz	
	Config 3, 6		30 KHz	
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	

csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2, 4, 5	dBm/SCS kHz	-98	Threshold used for $Q_{in\_LR\_SSB}$
	Config 3, 6		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for q_0 and q_1	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1, 4		CSI-RS.1.1 FDD	A.3.14
	Config 2, 5		CSI-RS.1.1 TDD	
	Config 3, 6		CSI-RS.2.1 TDD	
TRS configuration	Config 1, 4		TRS.1.1 FDD	
	Config 2, 5		TRS.1.1 TDD	
	Config 3, 6		TRS.1.2 TDD	
csi-RS-Index assigned as RLM RS	Config 1, 4		CSI-RS.1.2 FDD	A.3.14
	Config 2, 5		CSI-RS.1.2 TDD	
	Config 3, 6		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	8.37	
T3		s	6.44	
T4		s	0	
T5		s	1.97	
D1		s	1.93	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.4.5.5.4.1-3: Cell specific test parameters for FR1 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1, 4	dB	5	-3	-12	-12	-12
	Config 2, 5		5	-3	-12	-12	-12
	Config 3, 6		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1, 4	dB	-10	-10	10	10	10
	Config 2, 5		-10	-10	10	10	10
	Config 3, 6		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1, 4	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2, 5		-108	-108	-88	-88	-88
	Config 3, 6		-105	-105	-85	-85	-85
N_{oc}	Config 1, 4	dBm/15 KHz	-98				
	Config 2, 5		-98				
	Config 3, 6		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.4.5.5.4.1-4: Void

Table A.4.5.5.4.1-5: Void

Table A.4.5.5.4.1-6: Void

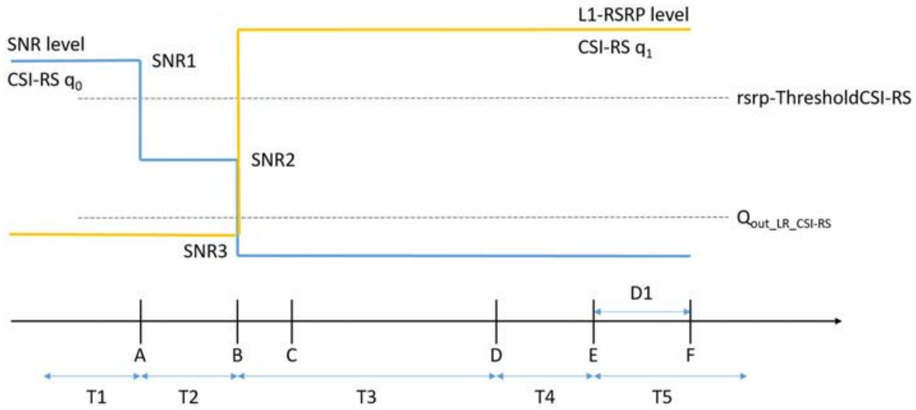


Figure A.4.5.5.4.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.4.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.6 Active BWP switch

A.4.5.6.1 DCI-based and Timer-based Active BWP Switch

A.4.5.6.1.1 E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC

A.4.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in TS38.133 clause 8.6, and interruption requirement for E-UTRA victim cell defined in TS36.133 clause 7.32.2.7. Supported test configurations are shown in Table A.4.5.6.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in Table A.4.5.6.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in Table A.4.5.6.1.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after DL slot ($i+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the beginning slot of the DL subframe immediately after the *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell at latest at the beginning of the DL slot right after DL slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after DL slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of PSCell, respectively.

Table A.4.5.6.1.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations. Note 2: A UE which fulfils the requirements in test case A.4.5.6.1.2 can skip the test cases in A.4.5.6.1.1.	

Table A.4.5.6.1.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
bwp-InactivityTimer	ms	[200]	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	μs	3	Synchronous EN-DC
T1	s	[0.2]	
T2	s	[0.2]	
T3	s	[0.2]	

Table A.4.5.6.1.1.1-3.: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR1
Duplex mode	Config 1,4		FDD
	Config 2,3,5,6		TDD
TDD configuration	Config 1,4		Not Applicable
	Config 2,5		TDDConf.1.1
	Config 3,6		TDDConf.1.2
$BW_{channel}$	Config 1,4		10 MHz: $N_{RB,c}$ = 52
	Config 2,5		10 MHz: $N_{RB,c}$ = 52
	Config 3,6		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			1, 2
Initial DL BWP Configuration	Config 1,4		DLBWP.0.2 Note 4
	Config 2,5		
	Config 3,6		
Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.1 Note 4
	Config 2,5		
	Config 3,6		
Active DL BWP-2 Configuration	Config 1,4		DLBWP.1.3 Note 4
	Config 2,5		
	Config 3,6		
Initial UL BWP Configuration	Config 1,4		ULBWP.0.2 Note 4
	Config 2,5		
	Config 3,6		
Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.1 Note 4
	Config 2,5		
	Config 3,6		
Active UL BWP-2 Configuration	Config 1,4		ULBWP.1.3 Note 4
	Config 2,5		
	Config 3,6		
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD
	Config 2,5		SR.1.1 TDD
	Config 3,6		SR.2.1 TDD
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD
	Config 2,5		CR.1.1 TDD
	Config 3,6		CR.2.1 TDD
Dedicated CORESET parameters	Config 1,4		CCR.1.1 FDD
	Config 2,5		CCR.1.1 TDD
	Config 3,6		CCR.2.1 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2,4,5		SSB.1 FR1
	Config 3,6		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2,4,5	dBm/SCS	[-104]

	Config 3,6		[-101]
N_{oc} Note 2		dBm/15kHz	-104
SS-RSRP Note 3	Config 1,2,4,5	dBm/SCS	[-87]
	Config 3,6		[-90]
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36MHz	[-59]
	Config 3,6	dBm/38.16MHz	[-61.9]
Propagation Condition			AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for Noc to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.4.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in the DL slot right after DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start time of PCell interruption during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start time of PCell interruption of during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS36.133 Clause 7.32.2.7.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.4.5.6.1.2 E-UTRAN – NR PSCell FR1 DL active BWP switch with FR1 SCell in non-DRX in synchronous EN-DC

A.4.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirements for NR victim cell defined in clause 8.2.1.2.7 and interruption requirement for E-UTRA victim cell defined in clause 7.32.2.7 of TS 36.133 [15]. Supported test configurations are shown in Table A.4.5.6.1.2.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in Table A.4.5.6.1.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCell are specified in Table A.4.5.6.1.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and SCell (Cell 3) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3 (SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for SCell, BWP-0 in Cell 3 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in SCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted i. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the beginning slot of the DL subframe immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell at latest at the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell and NR SCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell and SCell during BWP switch of PSCell, respectively.

Table A.4.5.6.1.2.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: A UE which fulfils the requirements in test case A.4.5.6.1.2 can skip the test cases in A.4.5.6.1.1. Note 3: NR configuration is the same for PSCell and SCells.	

Table A.4.5.6.1.2.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3	Two NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
Active SCell		Cell 3	SCell on RF channel number 3.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	[200]	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on SCC.
Cell2 timing offset to cell1	µs	3	Synchronous EN-DC
Cell3 timing offset to cell2	µs	3	Synchronous cells
T1	s	[0.2]	
T2	s	[0.2]	
T3	s	[0.2]	

Table A.4.5.6.1.2.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR1	
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2,5		TDDConf.1.1	
	Config 3,6		TDDConf.1.2	
$BW_{channel}$	Config 1,4		10 MHz: $N_{RB,c}$ = 52	
	Config 2,5		10 MHz: $N_{RB,c}$ = 52	
	Config 3,6		40 MHz: $N_{RB,c}$ = 106	
Active BWP ID			1, 2	0
Initial BWP Configuration	Config 1,4		DLBWP.0.2	DLBWP.0.2
	Config 2,5			
	Config 3,6			
Active BWP-0 Configuration	Config 1,4		NA	DLBWP.0.2
	Config 2,5			
	Config 3,6			
Active BWP-1 Configuration	Config 1,4		DLBWP.1.3	NA
	Config 2,5			
	Config 3,6			
Active BWP-2 Configuration	Config 1,4		DLBWP.1.1	NA
	Config 2,5			
	Config 3,6			
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD	
RMSI CORESET parameters	Config 1,4		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD	
	Config 3,6		CR2.1 TDD	
Dedicated CORESET parameters	Config 1,4		CCR.1.1 FDD	
	Config 2,5		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD	
OCNG Patterns			OP.1	
SSB Configuration	Config 1,2,4,5		SSB.1 FR1	
	Config 3,6		SSB.2 FR1	
SMTC Configuration			SMTC.1	
TRS Configuration	Config 1,4		TRS.1.1 FDD	
	Config 2,5		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD	
Antenna Configuration			1x2	
Propagation Condition			AWGN	
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note 2		dBm/15 kHz	[-104]	[-104]
SS-RSRP Note 3		dBm/15 kHz	[-87]	[-87]
$\hat{E}_s/I_{ot}$		dB	17	17
$\hat{E}_s/N_{oc}$		dB	17	17
Io Note3	Config 1,2,4,5	dBm/9.36MHz	[-59]	[-59]
	Config 3,6	dBm/38.16MHz	[-61.9]	[-61.9]

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].

A.4.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in the DL slot right after slot ($j+T_{BWPswitchDelay}+k11$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in clause 7.32.2.7 of TS 36.133 [15].

During T1, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.6.2.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

Editor's note: FFS value of k1 for type 1 and type 2 UE.

A.4.5.6.2 RRC-based Active BWP Switch

A.4.5.6.2.1 E-UTRAN – NR PSCell FR1 DL active BWP switch in non-DRX in synchronous EN-DC

A.4.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.3. Supported test configurations are shown in Table A.4.5.6.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) as given in Table A.4.5.6.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell are specified in Table A.4.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PSCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PSCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$) as defined in clause 8.6.3 and be ready for the reception of uplink grant for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$).

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated BWP configurationis sent till the time when RRC Reconfiguration Complete message is received.

Table A.4.5.6.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.4.5.6.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	µs	3	Synchronous EN-DC
T1	s	[0.2]	

Table A.4.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter			Unit	Cell 2
Frequency Range				FR1
Duplex mode		Config 1,4		FDD
		Config 2,3,5,6		TDD
TDD configuration		Config 1,4		Not Applicable
		Config 2,5		TDDConf.1.1
		Config 3,6		TDDConf.1.2
$BW_{channel}$		Config 1,4		10 MHz: $N_{RB,c}$ = 52
		Config 2,5		10 MHz: $N_{RB,c}$ = 52
		Config 3,6		40 MHz: $N_{RB,c}$ = 106
Active DL BWP ID				1, 2
Initial DL BWP Configuration		Config 1,4		DLBWP.0.2
		Config 2,5		
		Config 3,6		
Initial UL BWP Configuration		Config 1,4		ULBWP.0.2
		Config 2,5		
		Config 3,6		
Initial Condition	Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.3
		Config 2,5		
		Config 3,6		
	Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.3
		Config 2,5		
		Config 3,6		
Final Condition	Active DL BWP-1 Configuration	Config 1,4		DLBWP.1.1
		Config 2,5		
		Config 3,6		
	Active UL BWP-1 Configuration	Config 1,4		ULBWP.1.1
		Config 2,5		
		Config 3,6		
Initial UL BWP Configuration		Config 1,4		ULBWP.0.2
		Config 2,5		
		Config 3,6		
Active UL BWP-1 Configuration		Config 1,4		ULBWP.1.3
		Config 2,5		
		Config 3,6		
Active UL BWP-2 Configuration		Config 1,4		ULBWP.1.1
		Config 2,5		
		Config 3,6		
PDSCH Reference measurement channel		Config 1,4		SR.1.1 FDD
		Config 2,5		SR.1.1 TDD
		Config 3,6		SR2.1 TDD
RMSI CORESET parameters		Config 1,4		CR.1.1 FDD
		Config 2,5		CR.1.1 TDD
		Config 3,6		CR2.1 TDD
Dedicated CORESET parameters		Config 1,4		CCR.1.1 FDD
		Config 2,5		CCR.1.1 TDD
		Config 3,6		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2,4,5		SSB.1 FR1
		Config 3,6		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1,4		TRS.1.1 FDD
		Config 2,5		TRS.1.1 TDD
		Config 3,6		TRS.1.2 TDD
Antenna Configuration				1x2

Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	[-104]
SS-RSRP Note 3		dBm/15 kHz	[-87]
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2,4,5	dBm/9.36MHz	[-59]
	Config 3,6	dBm/38.16MHz	[-61.9]
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.4.5.6.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell in the beginning of the DL slot right after slot ($i+ T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.5.7 PSCell addition and release delay

A.4.5.7.1 Addition and Release Delay of known NR PSCell

A.4.5.7.1.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell addition and release delays under EN-DC are within the requirements stated in clause 7.31.2 [15] for the case when the PSCell is known by the UE at the time of addition.

Supported test configurations are shown in A.4.5.7.1.1-1. The test parameters for the E-UTRA cell are given in Table A.3.7.2.1-1. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in Tables A.4.5.7.1.1-2 and cell-specific parameters in A.4.5.7.1.1-3 below. The test consists of five successive time periods with duration of T1, T2, T3, T4 and T5 respectively. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell1 is known to the UE.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A4 is configured for neighbour cell (Cell2). Before the start of T2 the UE is configured with the measurement gaps (gap pattern Id # 0). The Cell2 becomes known to the UE during T2. Therefore, during T2 the UE shall report Event A4. After receiving the Event A4, the test system shall send a RRC message to the UE to release the measurement gaps.

The test system shall send a RRC message to the UE to add PSCell (Cell 2) on radio channel 2. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added. The RRC message to add PSCell shall be sent to the UE during period T2, after the measurement gaps are released by the test system. The point in time at which the RRC message to add PSCell (Cell2) is received at the UE antenna connector defines the start of period T3.

The test system shall observe the periodic reporting of CSI for PSCell during T4. The point in time at which the UE has sent PRACH to the PSCell (Cell 2) defines the start of period T4.

The test system shall send a RRC message to the UE to release PSCell (Cell 2) on radio channel 2. The RRC message to release PSCell (Cell2) shall be sent to the UE during period T4, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to release PSCell (Cell2) is received at the UE antenna connector defines the start of period T5.

Table A.4.5.7.1.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	LTE FDD, NR SCS 15 kHz, BW 10 MHz, FDD
2	LTE FDD, NR SCS 15 kHz, BW 10 MHz, TDD
3	LTE FDD, NR SCS 30 kHz, BW 40 MHz, TDD
4	LTE TDD, NR SCS 15 kHz, BW 10 MHz, FDD
5	LTE TDD, NR SCS 15 kHz, BW 10 MHz, TDD
6	LTE TDD, NR SCS 30 kHz, BW 40 MHz, TDD
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.4.5.7.1.1-2: General Test Parameters for PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell
Initial	Active PCell		Cell1	PCell on RF channel number 1.
	Neighbour cell		Cell2	Neighbour cell on RF channel number 2.
Final Condition	Active PCell		Cell1	PCell on RF channel number 1.
	Neighbour Cell		Cell2	PSCell released on RF channel number 2.
B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	-93	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	S	0	
DRX			OFF	Continuous monitoring of primary cell
Measurement gap pattern Id			0	Gaps are configured before T2 and released before T3.
PRACH configuration on cell2			FR1 PRACH configuration 2	Captured in A.3.8.2.1
CQI/PMI periodicity and offset configuration index on cell2			2ms	CQI reporting for PSCell every uplink subframe
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of cell2.
T1		s	1	During this time the PCell shall be known and cell2 shall be unknown.
T2		s	1	During this time the UE shall identify neighbour cell (cell2) and report event B1.
T3		s	0.5	During this time the UE adds the PSCell.
T4		s	0.5	During this time the UE sends CSI reports for PSCell.
T5		s	0.5	During this time the UE releases the PSCell.

Table A.4.5.7.1.1-3: Cell Specific Parameters for PSCell Addition and Release

Parameter	Unit	Config	Test				
			T1	T2	T3	T4	T5

E-UTRA RF Channel Number		1,2,3,4,5,6	1	
NR RF Channel Number		1,2,3,4,5,6	2	
TDD configuration		1,4	Not Applicable	
		2,5	TDDConf.1.1	
		3,6	TDDConf.1.2	
$BW_{channel}$	MHz	1,4	10: $N_{RB,c}$ = 52	
		2,5	10: $N_{RB,c}$ = 52	
		3,6	40: $N_{RB,c}$ = 106	
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1	
PDSCH Reference measurement channel		1,4	SR.1.1 FDD	
		2,5	SR.1.1 TDD	
		3,6	SR.2.1 TDD	
RMSI CORESET Reference Channel		1,4	CR.1.1 FDD	
		2,5	CR.1.1 TDD	
		3,6	CR.2.1 TDD	
Dedicated CORESET Reference Channel		1,4	CCR.1.1 FDD	
		2,5	CCR.1.1 TDD	
		3,6	CCR.2.1 TDD	
OCNG Patterns		1,2,3,4,5,6	OP.1	
SSB configuration		1,2,4,5	SSB.1 FR1	
		3,6	SSB.2 FR1	
SMTC configuration		1,2,4,5	SMTC.1	
		3,6	SMTC.1	
TRS Configuration		1,4	TRS.1.1 FDD	
		2,5	TRS.1.1 TDD	
		3,6	TRS.1.2 TDD	
EPRE ratio of PSS to SSS	dB	1,2,3,4,5,6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1,2,3,4,5,6	N/A	-85
N_{oc} Note2	dBm/SCS	1,2,4,5	N/A	-85
		3,6	N/A	-82
$\hat{E}_s/I_{ot}$		1,2,3,4,5,6	-infinity	0
$\hat{E}_s/N_{oc}$		1,2,3,4,5,6	-infinity	0
SS-RSRP Note3	dBm/SCS	1,2,4,5	-infinity	-85
		3,6	-infinity	-82
Io Note3	dBm/9.36MHz	1,2,4,5	N/A	-57

	dBm/38.1MHz	3,6	N/A	-51
Propagation condition		1,2,3,4,5,6	AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.				

A.4.5.7.1.2 Test Requirements

The UE shall transmit the PRACH to PSCell at latest 82 ms[Note1] into T3.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T4.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T4

The UE shall stop sending CSI reports for PSCell in at latest 20ms into T5.

All the above test requirements shall be fulfilled in order for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90%.

Note1: The PSCell addition delay can be expressed as follows as specified in clause 7.31.2 [15]:

$$T_{config\_PSCell} = T_{RRC\_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell\_DU} + 2ms$$

Where:

T_{RRC_delay} = 20ms

$T_{processing}$ = 20ms

T_{search} = 0

T_{Δ} = 20ms

T_{PSCell_DU} = 1*10+10 = 20ms

A.4.5.8 DL Interruptions at switching between two uplink carriers

A.4.5.8.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink carriers defined in clause 8.2.1.2.14. The test case is applicable for an uplink band pair of an inter-band EN-DC configuration when the capability *uplinkTxSwitchingPeriod* is present.

There are two cells: E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters for PSCell are given in Table A. 4.5.8.1-1, Table A. 4.5.8.1-2 and Table A. 4.5.8.1-3 below.

Aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting [6dB] on the symbol#5 if UE capability *uplinkTxSwitchingPeriod* is 140us or symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 35us on the special slot on NR TDD carrier (Cell 2). The test parameters and applicability for E-UTRAN PCell are defined in A.3.7.2.

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE. This test verifies that the UE correctly report the L1-RSRP reporting.

Table A. 4.5.8.1-1: Supported test configurations

Configuration	PSCell (Cell2)
1	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A. 4.5.8.1-2: General test parameters for DL Interruptions at switching between two uplink carriers in EN-DC

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2	Two radio channels are used for the test.
Active cell		Config 1	Cell 1: E-UTRAN PCell Cell 2: FR1 PSCell	E-UTRAN PCell on RF channel number 1 FR1 PSCell on RF channel number 2
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A. 4.5.8.1-3: NR Cell specific test parameters for DL Interruptions at switching between two uplink carriers in EN-DC (Cell 2)

Parameter		Unit	Cell2
Frequency Range			FR1
Duplex mode	Config 1		TDD
TDD configuration	Config 1		TDDConf.2.1 except that: S='10DL:2GP:2UL'; *nrofDownlinkSymbols:10* *nrofUplinkSymbols: 2*
$BW_{channel}$	Config 1		40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL dedicated BWP configuration			ULBWP.1.1
SRS configuration			SRSConf.1 in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2
PDSCH Reference measurement channel	Config 1		SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.2.1 TDD
OCNG Patterns			OP.1
SMTC Configuration			SMTC.1
SSB Configuration	Config 1		SSB.2 FR1
Correlation Matrix and Antenna Configuration			2x2 low
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2		dBm/15 kHz	-104
SS-RSRP Note 3		dBm/15 kHz	-87
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
N_{oc} Note 2	Config 1	dBm/SCS	-101
Io Note3	Config 1	dBm/ 38.16MHz	-52.86
Time offset to Cell1 Note 5		µs	0
Propagation Condition			AWGN

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	Void
Note 5:	Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.4.5.8.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.1.2.14.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.1.

The rate of correct events observed during repeated tests shall be at least 90%.

A.4.6 Measurement procedure

A.4.6.1 Intra-frequency Measurements

A.4.6.1.1 EN-DC event triggered reporting tests without gap under non-DRX

A.4.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.4.6.1.1.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.1.2-1, A.4.6.1.1.2-2, A.4.6.1.1.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

Table A.4.6.1.1.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.1.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5	
CP length		1, 2, 3, 4, 5, 6	Normal	
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
Time To Trigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	N/A	OFF
Time offset between PCell and PSCell		1, 2, 3, 4, 5, 6	3 μs	Synchronous EN-DC
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		2, 5	3 μs	Synchronous cells
		3, 6	3 μs	Synchronous cells
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	5	

Table A.4.6.1.1.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2, 5	CR.1.1 TDD		CR.1.1 TDD	
		3, 6	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD		CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2, 5	-98			
		3, 6	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2, 5				
		3, 6				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2, 5				
		3, 6				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2, 5				
		3, 6				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3, 6	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.2 EN-DC event triggered reporting tests without gap under DRX

A.4.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.4.6.1.2.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.2.1-1, A.4.6.1.2.1-2, A.4.6.1.2.1-3 and A.4.6.1.2.1-4 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.1.2.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.2.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2		
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3		Cell to be identified.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3		
SSB configuration		1, 4	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.2 FR1		
SMTC configuration		1, 4	SMTC.2		
		2, 5	SMTC.1		
		3, 6	SMTC.1		
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5		
CP length		1, 2, 3, 4, 5, 6	Normal		
Hysteresis	dB	1, 2, 3, 4, 5, 6	0		
Time To Trigger	s	1, 2, 3, 4, 5, 6	0		
Filter coefficient		1, 2, 3, 4, 5, 6	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.1	DRX.2	
Time offset between PCell and PSCell		1, 2, 3, 4, 5, 6	3 µs		Synchronous EN-DC
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		2, 5	3 µs		Synchronous cells
		3, 6	3 µs		Synchronous cells
T1	s	1, 2, 3, 4, 5, 6	5		
T2	s	1, 2, 3, 4, 5, 6	5	10	

Table A.4.6.1.2.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 2 T1	Cell 2 T2	Cell 3 T1	Cell 3 T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2, 5	CR.1.1 TDD		CR.1.1 TDD	
		3, 6	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD		CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD		CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2, 5	-98			
		3, 6	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2, 5				
		3, 6				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2, 5				
		3, 6				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2, 5				
		3, 6				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.3 EN-DC event triggered reporting tests with per-UE gaps under non-DRX

A.4.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.4.6.1.3.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell.The test parameters for PSCell are given in Table A.4.6.1.3.1-1 and A.4.6.1.3.1-2 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.4.6.1.3.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.3.2-2: General test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3	
Measurement gap type		1, 2, 3, 4, 5, 6	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2, 3, 4, 5, 6	40	
Measurement gap length	ms	1, 2, 3, 4, 5, 6	6	
Measurement gap offset	ms	1, 2, 3, 4, 5, 6	39	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
CSI-RS parameters		1, 4	CSI-RS.1.2 FDD resource #0	
		2, 5	CSI-RS.1.2 TDD resource #0	
		3, 6	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5	
CP length		1, 2, 3, 4, 5, 6	Normal	
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
Time To Trigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	N/A	OFF
Time offset between PCell and PSCell		1, 2, 3, 4, 5, 6	3 µs	Synchronous EN-DC
Time offset between serving and neighbour cells		1, 4	3 ms	Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		2, 5	3 µs	Synchronous cells
		3, 6	3 µs	Synchronous cells
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	5	

Table A.4.6.1.3.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1

Parameter	Unit	Test configuration	Cell 2 T1	Cell 2 T2	Cell 3 T1	Cell 3 T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2, 5	CR.1.1 TDD		CR.1.1 TDD	
		3, 6	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.2 FDD		CCR.1.1 FDD	
		2, 5	CCR.1.2 TDD		CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3, 4, 5, 6	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2, 5	-98			
		3, 6	-95			
N_{oc} Note 2	dBm/15 kHz	1, 4	-98			
		2, 5				
		3, 6				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2, 5				
		3, 6				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2, 5				
		3, 6				
SS-RSRP Note 3	dBm/SCS kHz	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3, 6	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.1.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.4 EN-DC event triggered reporting tests with per-UE gaps under DRX

A.4.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.4.6.1.4.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.4.2-1, A.4.6.1.4.2-2, A.4.6.1.4.2-3 A.4.6.1.4.2-4 and A.4.6.1.4.2-5 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.1.4.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.4.2-2: General test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3, 4, 5, 6	E-UTRAN Cell 1 and NR Cell 2		
Neighbour cell		1, 2, 3, 4, 5, 6	NR Cell 3		**Cell to be identified.**
RF Channel Number		1, 2, 3, 4, 5, 6	1: Cell 1 2: Cell 2 and Cell 3		
Measurement gap type		1, 2, 3, 4, 5, 6	Per-UE gaps		
Measurement gap repitition periodicity	ms	1, 2, 3, 4, 5, 6	40		
Measurement gap length	ms	1, 2, 3, 4, 5, 6	6		
Measurement gap offset	ms	1, 2, 3, 4, 5, 6	39		
SSB configuration		1, 4	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.2 FR1		
SMTC configuration		1, 4	SMTC.2		
		2, 5	SMTC.1		
		3, 6	SMTC.1		
CSI-RS parameters		1, 4	CSI-RS.1.2 FDD resource #0		
		2, 5	CSI-RS.1.2 TDD resource #0		
		3, 6	CSI-RS.2.2 TDD resource #0		
A3-Offset	dB	1, 2, 3, 4, 5, 6	-4.5		
CP length		1, 2, 3, 4, 5, 6	Normal		
Hysteresis	dB	1, 2, 3, 4, 5, 6	0		
Time To Trigger	s	1, 2, 3, 4, 5, 6	0		
Filter coefficient		1, 2, 3, 4, 5, 6	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.1	DRX.2	
Time offset between PCell and PSCell		1, 2, 3, 4, 5, 6	3 µs		Synchronous EN-DC
Time offset between serving and neighbour cells		1, 4	3 ms		Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		2, 5	3 µs		Synchronous cells
		3, 6	3 µs		Synchronous cells
T1	s	1, 2, 3, 4, 5, 6	5		
T2	s	1, 2, 3, 4, 5, 6	5	10	

Table A.4.6.1.4.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting with per-UE gaps for PSCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 4	N/A		N/A	
		2, 5	TDDConf.1.1		TDDConf.1.1	
		3, 6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD		N/A	
		2, 5	SR.1.1 TDD			
		3, 6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD		CR.1.1 FDD	
		2, 5	CR.1.1 TDD		CR.1.1 TDD	
		3, 6	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.2 FDD		CCR.1.1 FDD	
		2, 5	CCR.1.2 TDD		CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		OP.1	
TRS configuration		1, 4	TRS.1.1 FDD		N/A	
		2, 5	TRS.1.1 TDD		N/A	
		3, 6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3, 4, 5, 6	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 4	-98			
		2, 5	-98			
		3, 6	-95			
N_{oc} Note 2	dBm/15 KHz	1, 4	-98			
		2, 5				
		3, 6				
$\hat{E}_s/I_{ot}$	dB	1, 4	4	-1.46	-Infinity	-1.46
		2, 5				
		3, 6				
$\hat{E}_s/N_{oc}$	dB	1, 4	4	4	-Infinity	4
		2, 5				
		3, 6				
SS-RSRP Note 3	dBm/SCS KHz	1, 4	-94	-94	-Infinity	-94
		2, 5	-94	-94	-Infinity	-94
		3, 6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1, 4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2, 5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3, 6	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN			
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.1.4.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.5 EN-DC event triggered reporting tests without gap under non-DRX with SSB index reading

A.4.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.4.6.1.5.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell.The test parameters for FDD PSCell are given in Table A.4.6.1.5.1-1 and A.4.6.1.5.1-2 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

Table A.4.6.1.5.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.5.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for FDD PSCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 2: Cell 2 and Cell 3	
SSB configuration		1, 2	SSB.1 FR1	
SMTC configuration		1, 2	SMTC.2	
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	N/A	OFF
Time offset between PCell and PSCell		1, 2	3 µs	Synchronous EN-DC
Time offset between serving and neighbour cells		1, 2	3 ms	Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.4.6.1.5.1-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for FDD PSCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 2	N/A		N/A	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET RMC configuration		1, 2	CCR.1.1 FDD		CCR.1.1 FDD	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.1.5.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.6 EN-DC event triggered reporting tests with SSB index reading with per-UE gaps

A.4.6.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.4.6.1.6.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.6.2-1 A.4.6.1.6.2-2 and A.4.6.1.6.2-3 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.4.6.1.6.2-1: Supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.6.2-2: General test parameters for EN-DC intra-frequency event triggered reporting with gap for PSCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 2: Cell 2 and Cell 3	
Measurement gap type		1, 2	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2	40	
Measurement gap length	ms	1, 2	6	
Measurement gap offset	ms	1, 2	39	
SSB configuration		1, 2	SSB.1 FR1	
SMTC configuration		1, 2	SMTC.2	
CSI-RS parameters		1, 2	CSI-RS.1.2 FDD resource #0	
A3-Offset	dB	1, 2	-4.5	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	N/A	OFF
Time offset between PCell and PSCell		1, 2	3 µs	Synchronous EN-DC
Time offset between serving and neighbour cells		1, 2	3 ms	Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.4.6.1.6.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting with gap for PSCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1, 2	N/A		N/A	
PDSCH RMC configuration		1, 2	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET RMC configuration		1, 2	CCR.1.2 FDD		CCR.1.1 FDD	
OCNG Patterns		1, 2	OP.1		OP.1	
TRS configuration		1, 2	TRS.1.1 FDD		N/A	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1, 2	-98			
N_{oc} Note 2	dBm/15 kHz	1, 2	-98			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1, 2	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1, 2	-64.60	-62.25	-64.60	-62.25
Propagation Condition		1, 2	AWGN			
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.1.6.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.1.7 EN-DC event triggered reporting tests under DRX for UE configured with highSpeedMeasFlag-r16

A.4.6.1.7.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event for UE configured with highSpeedMeasFlag-r16. This test will partly verify the intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.4.6.1.7.2 Test parameters

Three cells are deployed in the test, which are E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters for PSCell are given in Table A.4.6.1.7.1-1, A.4.6.1.7.1-2, A.4.6.1.7.1-3 and A.4.6.1.7.1-4 below and the test parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.1.7.2-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations. Note 2: Target NR Cell 3 has the same SCS, BW and duplex mode as NR serving Cell 2	

Table A.4.6.1.7.2-2: General test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Test configuration	Value	Comment
highSpeedMeasFlag-r16		1,2,3,4,5,6	Present	To enable high speed measurement enhancements
Active cell		1, 2, 3,4,5,6	E-UTRAN Cell 1 and NR Cell 2	
Neighbour cell		1, 2, 3,4,5,6	NR Cell 3	Cell to be identified.
RF Channel Number		1, 2, 3,4,5,6	1: Cell 1 2: Cell 2 and Cell 3	
SSB configuration		1,4	SSB.1 FR1	
		2,5	SSB.1 FR1	
		3,6	SSB.2 FR1	
SMTC configuration		1,4	SMTC.2	
		2,5	SMTC.1	
		3,6	SMTC.1	
A3-Offset	dB	1, 2, 3,4,5,6	-4.5	
CP length		1, 2, 3,4,5,6	Normal	
Hysteresis	dB	1, 2, 3,4,5,6	0	
Time To Trigger	s	1, 2, 3,4,5,6	0	
Filter coefficient		1, 2, 3,4,5,6	0	L3 filtering is not used
DRX		1, 2, 3,4,5,6	DRX.2.	640ms DRX cycle
Time offset between PCell and PSCell		1, 2, 3,4,5,6	3 µs	Synchronous EN-DC
Time offset between serving and neighbour cells		1,4	3 ms	Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		2,5	3 µs	Synchronous cells
		3,6	3 µs	Synchronous cells
T1	s	1, 2, 3,4,5,6	5	
T2	s	1, 2, 3,4,5,6	6	

Table A.4.6.1.7.2-3: NR Cell specific test parameters for EN-DC intra-frequency event triggered reporting without gap for PSCell in FR1 with DRX for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1,4	N/A		N/A	
		2,5	TDDConf.1.1		TDDConf.1.1	
		3,6	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1,4	SR.1.1 FDD		N/A	
		2,5	SR.1.1 TDD			
		3,6	SR.2.1 TDD			
RMSI CORESET RMC configuration		1,4	CR.1.1 FDD		CR.1.1 FDD	
		2,5	CR.1.1 TDD		CR.1.1 TDD	
		3,6	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1,4	CCR.1.1 FDD		CCR.1.1 FDD	
		2,5	CCR.1.1 TDD		CCR.1.1 TDD	
		3,6	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3,4,5,6	OP.1		OP.1	
TRS configuration		1,4	TRS.1.1 FDD		N/A	
		2,5	TRS.1.1 TDD		N/A	
		3,6	TRS.1.2 TDD		N/A	
Initial BWP configuration		1, 2, 3,4,5,6	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3,4,5,6	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3,4,5,6	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3,4,5,6	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1,4	-98			
		2,5	-98			
		3,6	-95			
N_{oc} Note 2	dBm/15 kHz	1,4	-98			
		2,5				
		3,6				
$\hat{E}_s/I_{ot}$	dB	1,4	4	-1.46	-Infinity	-1.46
		2,5				
		3,6				
$\hat{E}_s/N_{oc}$	dB	1,4	4	4	-Infinity	4
		2,5				
		3,6				
SS-RSRP Note 3	dBm/SCS kHz	1,4	-94	-94	-Infinity	-94
		2,5	-94	-94	-Infinity	-94
		3,6	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1,4	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2,5	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3,6	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2,4,5	AWGN		AWGN 1944 Hz Note 4	
		3,6	AWGN		AWGN 3334 Hz Note 5	

Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944Hz.
Note 5:	The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334Hz.

A.4.6.1.7.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 5120 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.2 Inter-frequency Measurements

A.4.6.2.1 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is not used

A.4.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.1.1-1, A.4.6.2.1.1-2, and A.4.6.2.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.1.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.4.6.2.1.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.1.1-1.

Table A.4.6.2.1.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2	

Table A.4.6.2.1.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	4	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9	9	
A3-Offset	dB	Config 1,2,3,4,5,6	-6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3 ms		Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3 μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	1	1	

Table A.4.6.2.1.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			
		Config 2,3,5,6	TDD			
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.1.1	
		Config 3,6	TDDConf.2.1		TDDConf.2.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration		Config 1,4	TRS.1.1 FDD		NA	
		Config 2,5	TRS.1.1 TDD		NA	
		Config 3,6	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
SSB parameters		Config 1,4	SSB.1 FR1		SSB.5 FR1	
		Config 2,5	SSB.1 FR1		SSB.5 FR1	
		Config 3,6	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2		SMTC.5	
		Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15			
		Config 3,6	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15kHz		-98		-98	

N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.4.6.2.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 760 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.2.2 EN-DC event triggered reporting tests for FR1 cell without SSB time index detection when DRX is used

A.4.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.2.1-1, A.4.6.2.2.1-2, and A.4.6.2.2.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.2.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #4 as defined in Table A.4.6.2.2.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.2.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.2.2.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2	

Table A.4.6.2.2.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1				One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2				Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		4		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9		9		
A3-Offset	dB	Config 1,2,3,4,5,6	-6				
Hysteresis	dB	Config 1,2,3,4,5,6	0				
CP length		Config 1,2,3,4,5,6	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6	0				
Filter coefficient		Config 1,2,3,4,5,6	0				L3 filtering is not used
DRX	ms	Config 1,2,3,4,5,6	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms				Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs				Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5				
T2	s	Config 1,2,3,4,5,6	1.1	11	1.1	11	

Table A.4.6.2.2.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			

		Config 2,3,5,6	TDD	
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52	
		Config 2,5	10: $N_{RB,c}$ = 52	
		Config 3,6	40: $N_{RB,c}$ = 106	
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52	
		Config 2,5	10: $N_{RB,c}$ = 52	
		Config 3,6	40: $N_{RB,c}$ = 106	
TDD configuration		Config 2,5	TDDConf.1.1	
		Config 3,6	TDDConf.2.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1	NA
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1	NA
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1	NA
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1	NA
TRS configuration		Config 1,4	TRS.1.1 FDD	NA
		Config 2,5	TRS.1.1 TDD	NA
		Config 3,6	TRS.1.2 TDD	NA
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1	OP.1
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD	-
		Config 2,5	SR.1.1 TDD	
		Config 3,6	SR2.1 TDD	
CORESET Reference Channel		Config 1,4	CR.1.1 FDD	-
		Config 2,5	CR.1.1 TDD	
		Config 3,6	CR2.1 TDD	
SSB parameters		Config 1,4	SSB.1 FR1	SSB.5 FR1
		Config 2,5	SSB.1 FR1	SSB.5 FR1
		Config 3,6	SSB.2 FR1	SSB.6 FR1
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2	SMTC.5
		Config 2,3,5,6	SMTC.1	SMTC.4
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15	
		Config 3,6	30	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz		-98	-98

N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36 MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16 MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.4.6.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2, 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.2.3 Void

A.4.6.2.4 Void

A.4.6.2.5 EN-DC event triggered reporting tests for FR1 cell with SSB time index detection when DRX is not used

A.4.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.5.1-1, A.4.6.2.5.1-2, and A.4.6.2.5.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.5.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.4.6.2.5.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.5.1-1.

Table A.4.6.2.5.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2	

Table A.4.6.2.5.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	4	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9	9	
A3-Offset	dB	Config 1,2,3,4,5,6	-6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 µs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms		Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3µs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	1.1	1	

Table A.4.6.2.5.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	**Unit**	**Test configuration**	**Cell 2**		**Cell 3**	
			T1	**T2**	**T1**	**T2**
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			
		Config 2,3,5,6	TDD			
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
TDD configuration		Config 2,5	TDDConf.1.1			
		Config 3,6	TDDConf.2.1			
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
TRS configuration		Config 1,4	TRS.1.1 FDD		NA	
		Config 2,5	TRS.1.1 TDD		NA	
		Config 3,6	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD			
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
SSB parameters		Config 1,4	SSB.1 FR1		SSB.5 FR1	
		Config 2,5	SSB.1 FR1		SSB.5 FR1	
		Config 3,6	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2		SMTC.5	
		Config 2,3,5,6	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15			
		Config 3,6	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						

EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.4.6.2.5.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 880 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.2.6 EN-DC event triggered reporting tests for FR1 cell with SSB time index detection when DRX is used

A.4.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR1 on NR RF channel 2. The test parameters and configurations are given in Tables A.4.6.2.6.1-1, A.4.6.2.6.1-2, and A.4.6.2.6.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.4.6.2.6.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #4 as defined in Table A.4.6.2.6.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.4.6.2.6.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.4.6.2.6.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell3 has the same SCS, BW and duplex mode as NR serving cell2	

Table A.4.6.2.6.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1				One E-UTRAN TDD carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2				Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		4		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	9		9		
A3-Offset	dB	Config 1,2,3,4,5,6	-6				
Hysteresis	dB	Config 1,2,3,4,5,6	0				
CP length		Config 1,2,3,4,5,6	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6	0				
Filter coefficient		Config 1,2,3,4,5,6	0				L3 filtering is not used
DRX	ms	Config 1,2,3,4,5,6	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms				Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs				Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5				
T2	s	Config 1,2,3,4,5,6	1.3	13.5	1.3	13.5	

Table A.4.6.2.6.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2 T1	Cell 2 T2	Cell 3 T1	Cell 3 T2
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD			
		Config 2,3,5,6	TDD			
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52			
		Config 2,5	10: $N_{RB,c}$ = 52			
		Config 3,6	40: $N_{RB,c}$ = 106			
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
TDD configuration		Config 2,5	TDDConf.1.1			
		Config 3,6	TDDConf.2.1			
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1			
TRS configuration		Config 1,4	TRS.1.1 FDD		N/A	
		Config 2,5	TRS.1.1 TDD		N/A	
		Config 3,6	TRS.1.2 TDD		N/A	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1			
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1			
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1			
SSB parameters		Config 1,4	SSB.1 FR1			
		Config 2,5	SSB.1 FR1			
		Config 3,6	SSB.2 FR1			
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2			
		Config 2,3,5,6	SMTC.1			
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15			
		Config 3,6	30			
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						

EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98		-98	
		Config 3,6	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2,4,5	-94	-94	-Infinity	-91
		Config 3,6	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
Io Note3	dBm/9.36MHz	Config 1,2,4,5	-64.59	-64.59	-70.05	-62.26
	dBm/38.16MHz	Config 3,6	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3,4,5,6	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.4.6.2.6.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 13440 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 13440 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2, 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.2.7 Void

A.4.6.2.8 Void

A.4.6.3 Void

A.4.6.4 L1-RSRP measurement for beam reporting

A.4.6.4.1 SSB based L1-RSRP measurement when DRX is not used

A.4.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in Table A.4.6.4.1.1-1.

Table A.4.6.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.1.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.1.2-1 and Table A.4.6.4.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.4.6.4.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
DRX configuration	1~6		Off
reportConfigType	1~6		periodic
reportQuantity	1~6		ssb-Index-RSRP
Number of reported RS	1~6		2
L1-RSRP reporting period	1~6	slot	80
T1	1~6	s	5
T2	1~6	s	1
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~6	dBm/15kHz	-94.65			
N_{oc} Note2	1,2,4,5	dBm/SSB SCS	-94.65			
	3,6		-91.65			
$\hat{E}_s/I_{ot}$	1~6	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,4,5	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3,6		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4,5	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3,6	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~6	dB	0	0	-Infinity	3
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.4.1.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI$_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.4.2 SSB based L1-RSRP measurement when DRX is used

A.4.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in Table A.4.6.4.2.1-1.

Table A.4.6.4.2.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.2.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.2.2-1 and Table A.4.6.4.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.4.6.4.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
DRX configuration	1~6		DRX.3
reportConfigType	1~6		periodic
reportQuantity	1~6		ssb-Index-RSRP
Number of reported RS	1~6		2
L1-RSRP reporting period	1~6	slot	80
T1	1~6	s	5
T2	1~6	s	1
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~6	dBm/15kHz	-94.65			
N_{oc} Note2	1,2,4,5	dBm/SSB SCS	-94.65			
	3,6		-91.65			
$\hat{E}_s/I_{ot}$	1~6	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,4,5	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3,6		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4,5	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3,6	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~6	dB	0	0	-Infinity	3
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.4.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.4.3 CSI-RS based L1-RSRP measurement when DRX is not used

A.4.6.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in Table A.4.6.4.3.1-1.

Table A.4.6.4.3.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.3.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.3.2-1 and Table A.4.6.4.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2,4,5 and 8 for Config 3,6) of a frame and UE provides the report back based on the reporting configuration as defined in Table A.4.6.4.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.4.6.4.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
CSI-RS configuration	1,4		CSI-RS 1.3 FDD
	2,5		CSI-RS 1.3 TDD
	3,6		CSI-RS 2.3 TDD
OCNG Patterns	1~6		OP.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
DRX configuration	1~6		Off
reportConfigType	1~6		aperiodic
reportQuantity	1~6		cri-RSRP
Number of reported RS	1~6		2
qcl-Info	1~6		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~6	slots	26
T1	1~6	s	5
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to $SSS^{Note 1}$			
EPRE ratio of OCNG to OCNG DMRS $^{Note 1}$			
Propagation condition	1~6		AWGN

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.4.6.4.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~6	dBm/15kHz	-94.65	
N_{oc} Note1	1,2,4,5	dBm/SSB SCS	-94.65	
	3,6		-91.65	
$\hat{E}_s/I_{ot}$	1~6	dB	0	3
CSI-RS RSRP Note2	1,2,4,5	dBm/SSB SCS	-94.65	-91.65
	3,6		-91.65	-88.65
Io Note2	1,2,4,5	dBm/9.36 MHz	-63.69	-61.93
	3,6	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s/N_{oc}$	1~6	dB	0	3

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.4.6.4.3.3 Test Requirements

After 80ms from the beginning of the test, the UE shall send L1-RSRP report at slot 26 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.20.1.1 and relative accuracy requirement in clause 10.1.20.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.4.4 CSI-RS based L1-RSRP measurement when DRX is used

A.4.6.4.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in Table A.4.6.4.4.1-1.

Table A.4.6.4.4.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.4.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.4.2-1 and Table A.4.6.4.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2,4,5 and 8 for Config 3,6) of a frame and UE provides the report back based on the reporting configuration as defined in Table A.4.6.4.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.4.6.4.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
CSI-RS configuration	1,4		CSI-RS 1.3 FDD
	2,5		CSI-RS 1.3 TDD
	3,6		CSI-RS 2.3 TDD
OCNG Patterns	1~6		OP.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
DRX configuration	1~6		DRX.3
reportConfigType	1~6		aperiodic
reportQuantity	1~6		cri-RSRP
Number of reported RS	1~6		2
qcl-Info	1~6		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~6	slots	26
T1	1~6	s	5
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~6		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.4.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~6	dBm/15kHz	-94.65	
N_{oc} Note1	1,2,4,5	dBm/SSB SCS	-94.65	
	3,6		-91.65	
$\hat{E}_s/I_{ot}$	1~6	dB	0	3
CSI-RS RSRP Note2	1,2,4,5	dBm/SSB SCS	-94.65	-91.65
	3,6		-91.65	-88.65
Io Note2	1,2,4,5	dBm/9.36 MHz	-63.69	-61.93
	3,6	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s/N_{oc}$	1~6	dB	0	3
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.4.6.4.4.3 Test Requirements

After 80ms from the beginning of the test, the UE shall send L1-RSRP report at slot 26 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting absolute accuracy requirement in clause 10.1.20.1.1 and relative accuracy requirement in clause 10.1.20.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI$_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.4.5 SSB based L1-RSRP measurement when DRX is used for UE configured with *highSpeedMeasFlag-r16*

A.4.6.4.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement when UE is configured with *highSpeedMeasFlag-r16*. This test will partly verify the L1-RSRP measurement requirements for UE configured with *highSpeedMeasFlag-r16* in clause 9.5.4.1, with the testing configurations for NR cells in Table A.4.6.4.5.1-1.

Table A.4.6.4.5.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.4.6.4.5.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.6.4.5.2-1 and Table A.4.6.4.5.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.4.6.4.5.2-1: General test parameters for UE configured with *highSpeedMeasFlag-r16*

Parameter	Config	Unit	Value
SSB GSCN	1~6		freq1
Duplex mode	1,4		FDD
	2,5		TDD
	3,6		TDD
TDD Configuration	1,4		N/A
	2,5		TDDConf.1.1
	3,6		TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD
	2,5		SR.1.1 TDD
	3,6		SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD
	2,5		CR.1.1 TDD
	3,6		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD
	2,5		CCR.1.1 TDD
	3,6		CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1
	2,5		SSB.3 FR1
	3,6		SSB.4 FR1
OCNG Patterns	1~6		OP.1
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1
TRS Configuration	1,4		TRS.1.1 FDD
	2,5		TRS.1.1 TDD
	3,6		TRS.1.2 TDD
DRX configuration	1~6		DRX.8
reportConfigType	1~6		periodic
reportQuantity	1~6		ssb-Index-RSRP
Number of reported RS	1~6		2
L1-RSRP reporting period	1~6	slot	80
T1	1~6	s	5
T2	1~6	s	2
EPRE ratio of PSS to SSS	1~6	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			

Propagation condition	1,2,4,5		AWGN 1944 Hz
	3,6		AWGN 3334 Hz
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.4.6.4.5.2-2: SSB specific test parameters for UE configured with *highSpeedMeasFlag-r16*

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~6	dBm/15kHz	-94.65			
N_{oc} Note2	1,2,4,5	dBm/SSB SCS	-94.65			
	3,6		-91.65			
$\hat{E}_s/I_{ot}$	1~6	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2,4,5	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3,6		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2,4,5	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3,6	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~6	dB	0	0	-Infinity	3
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.4.6.4.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than [1920ms] plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.5 CLI measurements

A.4.6.5.1 SRS-RSRP measurement with non-DRX

A.4.6.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SRS-RSRP measurement. This test will verify the SRS-RSRP measurement requirements in clause 9.7.2.5 with the testing configurations for NR cells in Table A.4.6.5.1.1-1.

Table A.4.6.5.1.1-1: Applicable NR configurations for FR1 SRS-RSRP test

Configuration	Description
1	NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.4.6.5.1.2 Test Parameters

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters for PSCell is given in Table A.4.6.5.1.2-1 and A.4.6.5.1.2-2 below and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in Table A.4.6.5.1.2-4 and the test parameters for the (virtual) neighbour cell UE in Table A.4.6.5.1.2-3. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 1 data symbol before SRS to be transmitted.

Table A.4.6.5.1.2-1: General test parameters for SRS-RSRP event triggered reporting for PSCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	E-UTRAN Cell 1 and NR Cell 2	
RF Channel Number		1, 2	1: Cell 1 2: Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.2 FR1	
SMTC configuration		1	SMTC.1	
		2	SMTC.1	
SRS configuration		1	SRSConf.1	Table A.4.6.5.1.2-3
		2	SRSConf.2	
CP length		1, 2	Normal	
i1-Threshold	dBm	1	-97	
		2	-95	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	Non-DRX
Time offset between DL from serving cell and SRS from test system	µs	1,2	17.67	
T1	s	1, 2	5	
T2	s	1, 2	1	

Table A.4.6.5.1.2-2: NR Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell in FR1

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1	TDDConf.1.1	
		2	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 TDD	
		2	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 TDD	
		2	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 TDD	
		2	CCR.2.1 TDD	
OCNG Patterns		1, 2	OP.1	
TRS Configuration		1	TRS.1.1 TDD	
		2	TRS.1.2 TDD	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-95	
Propagation Condition		1, 2	AWGN	
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

Table A.4.6.5.1.2-3: NR Cell specific test parameters for SRS-RSRP event triggered reporting for neighbour cell UE

Parameter	Unit	Test configuration	Neighbour cell UE	
			T1	T2
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-95	
$\hat{E}_s/I_{ot}$	dB	1	-infinity	4
		2		
$\hat{E}_s/N_{oc}$	dB	1	-infinity	4
		2		
SRS-RSRP Note 3	dBm/SCS kHz	1	-infinity	-94
		2	-infinity	-91
Io	dBm/9.36 MHz	1	-70.05	-64.59
	dBm/38.16 MHz	2	-63.96	-58.50
Propagation Condition		1, 2	AWGN	
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.4.6.5.1.2-4: SRS configuration for measurement reporting

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	12	12	
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset	sl20, 9	sl40, 19	
	sequenceId	0	0	Any 10 bit number

A.4.6.5.1.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 60 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.6.5.2 CLI-RSSI measurement with non-DRX

A.4.6.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of CLI-RSSI measurement. This test will verify the CLI-RSSI measurement requirements in clause 9.7.3.5 with the testing configurations for NR cells in Table A.4.6.5.2.1-1.

Table A.4.6.5.2.1-1: Applicable NR configurations for FR1 CLI-RSSI test

Configuration	Description
1	NR 15 kHz SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.4.6.5.2.2 Test Parameters

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters for PSCell is given in Table A.4.6.5.2.2-1 and A.4.6.5.2.2-2 below and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI measurement resource and on 1 data symbol before. The CLI-RSSI measurement resource configuration is in Table A.4.6.5.2.2-3.

Table A.4.6.5.2.2-1: General test parameters for CLI-RSSI event triggered reporting for PSCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	E-UTRAN Cell 1 and NR Cell 2	
RF Channel Number		1, 2	1: Cell 1 2: Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.2 FR1	
SMTC configuration		1	SMTC.1	
		2	SMTC.1	
CLI-RSSI configuration		1	CLI-RSSIConf.1	Table A.4.6.5.2.2-3
		2	CLI-RSSIConf.2	
CP length		1, 2	Normal	
i1-Threshold	dBm	1	-93	
		2	-93	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	Non-DRX
Time offset between DL from serving cell and OCNG from test system	μs	1,2	17.67	
T1	s	1, 2	5	
T2	s	1, 2	1	

Table A.4.6.5.2.2-2: NR Cell specific test parameters for CLI-RSSI event triggered reporting for PSCell in FR1

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1	TDDConf.1.1	
		2	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 TDD	
		2	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 TDD	
		2	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 TDD	
		2	CCR.2.1 TDD	
OCNG Patterns Note 3		1, 2	OP.1	
TRS Configuration		1	TRS.1.1 TDD	
		2	TRS.1.2 TDD	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1	
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/15 kHz	1	-116	-108
		2		
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/SCS	1	-116	-108
		2	-113	-105
Io on CLI-RSSI measurement resource	dBm/9.36 MHz	1	-88.05	-80.05
	dBm/38.16 MHz	2	-81.96	-74.00
Io on CLI-RSSI measurement resource	dBm/1.08 MHz	1	-97.43	-89.43
	dBm/1.08 MHz	2	-97.44	-89.44
Propagation Condition		1, 2	AWGN	
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.4.6.5.2.2-3: CLI-RSSI measurement resource configuration for measurement reporting

	Field	CLI-RSSIConf.1	CLI-RSSIConf.2
RSSI-Resource	rssi-ResourceId	0	0
	rssi-SCS	15	30
	startPRB	0	0
	nrofPRBs	52	106
	startPosition	3	3
	nrofSymbols	11	11
	rssi-PeriodicityAndOffset	sl20, 9	sl40, 19

A.4.6.5.2.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 20 ms from the beginning of time period T2. The nominal RSSI used to evaluate the requirement shall be based on Io.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.4.7 Measurement Performance requirements

A.4.7.1 SS-RSRP

A.4.7.1.1 EN-DC Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.2.1.1 and 10.1.2.1.2 for intra-frequency measurements.

A.4.7.1.1.2 Test parameters

In this set of test cases all NR cells are on the same carrier frequency. Supported test configurations are shown in table A.4.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.4.7.1.1.2-2. The configuration of cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1 In all test cases, Cell 2 is the PSCell, and Cell 3 is the target cell.

Table A.4.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations for each supported band	

Table A.4.7.1.1.2-2: SS-RSRP Intra frequency test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
Physical cell ID				489	0	489	0	489	0
SSB ARFCN				freq1		freq1		freq1	
Duplex mode	Config 1,4			FDD					
	Config 2,3,5,6			TDD					
TDD configuration	Config 1,4			Not Applicable					
	Config 2,5			TDDConf.1.1					
	Config 3,6			TDDConf.2.1					
$BW_{channel}$	Config 1,4		MHz	10: $N_{RB,c}$ = 52					
	Config 2,5			10: $N_{RB,c}$ = 52					
	Config 3,6			40: $N_{RB,c}$ = 106					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
TRS configuration	Config 1,4			TRS.1.1 FDD	NA	TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2,5			TRS.1.1 TDD	NA	TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3,6			TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle			ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4			SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5			SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6			SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4			CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2,5			CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6			CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Control Channel RMC	Config 1,4			CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5			CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6			CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
SSB configuration	Config 1,4			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2,5			SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3,6			SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 2	Config 1,4		ms	-	3	-	3	-	3
	Config 2,3,5,6		µs	-	3	-	3	-	3
SMTC configuration	Config 1,4			SMTC.2					
	Config 2,3,5,6			SMTC.1					
OCNG Patterns				OP.1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5		kHz	15 kHz					
	Config 3,6			30kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15KhZ	-106		-88		-114	
		NR_FDD_FR1_B						-113.5	

		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable[Note 5]		-94		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
N_{oc} [Note2]	Config 1,2,4,5		dBm/SCS	-106		-88		Same as Noc/15kHz	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable[Note 5]		-91		-111	
		NR_FDD_FR1_B						-110.5	
		NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
$\hat{E}_s/I_{ot}$			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/N_{oc}$			dB	6	1	6	1	3	0
SS-RSRP[Note3]	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-100	-105	-82	-87	-111.00	-114.00
		NR_FDD_FR1_B						-110.50	-113.50
		NR_TDD_FR1_C						-110.00	-113.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.50	-112.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109.00	-112.00
		NR_FDD_FR1_F						-108.50	-111.50
		NR_FDD_FR1_G						-108.00	-111.00
		NR_FDD_FR1_H						-107.50	-110.50
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		- Not applicable[Note 5]	Not applicable[Note 5]	-85	-90	-108.00	-111.00
		NR_FDD_FR1_B						-107.50	-110.50
		NR_TDD_FR1_C						-107.00	-110.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-106.50	-109.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-106.00	-109.00
		NR_FDD_FR1_F						-105.50	-108.50
		NR_FDD_FR1_G						-105.00	-108.00
		NR_FDD_FR1_H						-104.50	-107.50
Io[Note3]	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36MHz	-70.09		-52.09		-80.03	
		NR_FDD_FR1_B						-79.53	

		NR_TDD_FR1_C				-79.03
		NR_FDD_FR1_D, NR_TDD_FR1_D				-78.53
		NR_FDD_FR1_E, NR_TDD_FR1_E				-78.03
		NR_FDD_FR1_F				-77.53
		NR_FDD_FR1_G				-77.03
		NR_FDD_FR1_H				-76.53
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16MHz	Not applicable Note 5	-51.99	-73.94
		NR_FDD_FR1_B				-73.44
		NR_TDD_FR1_C				-72.94
		NR_FDD_FR1_D, NR_TDD_FR1_D				-72.44
		NR_FDD_FR1_E, NR_TDD_FR1_E				-71.94
		NR_FDD_FR1_F				-71.44
		NR_FDD_FR1_G				-70.94
		NR_FDD_FR1_H				-70.44
Propagation condition			-	AWGN		
Antenna configuration				1x2		
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: Subtest 1 is not used when testing with 30kHz SSB SCS Note 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification						

A.4.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for cell 2 and cell 3 shall fulfil absolute requirement in clause 10.1.2.1.1 and relative requirement in clause 10.1.2.1.2.

A.4.7.1.2 EN-DC inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.4.1.1 and 10.1.4.1.2 for inter-frequency measurements with the testing configurations in Table A.4.7.1.2.1-1.

Table A.4.7.1.2.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations on each supported band	

A.4.7.1.2.2 Test parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR1 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.4.7.1.2.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in Table A.4.7.1.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.4.7.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN	1~6		freq1	freq2	freq1	freq2
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52		10: $N_{RB,c}$ = 52	
	2,5		10: $N_{RB,c}$ = 52		10: $N_{RB,c}$ = 52	
	3,6		40: $N_{RB,c}$ = 106		40: $N_{RB,c}$ = 106	
Gap pattern ID			0		0	
Duplex mode	1,4		FDD		FDD	
	2,5		TDD		TDD	
	3,6		TDD		TDD	
TDD configuration	1,4		N/A		N/A	
	2,5		TDDConf.1.1		TDDConf.1.1	
	3,6		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	2,5		SR.1.1 TDD		SR.1.1 TDD	
	3,6		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	2,5		CR.1.1 TDD	-	CR.1.1 TDD	-
	3,6		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2,5		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3,6		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1,4		SSB.1 FR1		SSB.1 FR1	
	2,5		SSB.1 FR1		SSB.1 FR1	
	3,6		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~6		OP.1		OP.1	
TRS configuration	1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-
	2,5		TRS.1.1 TDD		TRS.1.1 TDD	
	3,6		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 2	1,4	ms	-	3	-	3
	2,3,5,6	µs	-	3	-	3
SMTC configuration	1,4		SMTC.2		SMTC.2	
	2,3,5,6		SMTC.1		SMTC.1	
EPRE ratio of PSS to SSS	1~6	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS[Note 1]						
EPRE ratio of OCNG to OCNG DMRS [Note 1]						

N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1~6	dBm/15 kHz	-94.65		(N_{oc} for Cell 3 +8dB)	-115
	NR_FDD_FR1_B						-114.5
	NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NF_FDD_FR1_F						-112.5
	NR_FDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4,5	dBm/SSB SCS	-94.65		(N_{oc} for Cell 3 +8dB)	-115
	NR_FDD_FR1_B						-114.5
	NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5, NR_SDL_FR1_A	3,6		-91.65		(N_{oc} for C 3 +8dB)	-112.00
	NR_FDD_FR1_B						-112.50
	NR_TDD_FR1_C						-112.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-111.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-111.00
	NR_FDD_FR1_F						-110.50
	NR_FDD_FR1_G						-110.00
	NR_FDD_FR1_H						-110.50
$\hat{E}_s/I_{ot}$		1~6	dB	10	10	13	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SCS	-84.65		(RSRP for Cell 3 +25dB)	-118.00
	NR_FDD_FR1_B						-117.50
	NR_TDD_FR1_C						-117.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-116.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-116.00
	NR_FDD_FR1_F						-115.50
	NR_FDD_FR1_G						-115.00
	NR_FDD_FR1_H						-114.50
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3,6		-81.65		(RSRP for Cell 3 +25dB)	-115.00
	NR_FDD_FR1_B						-114.50
	NR_TDD_FR1_C						-114.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113.00
	NR_FDD_FR1_F						-112.50
	NR_FDD_FR1_G						-112.00

	NR_FDD_FR1_H						-111.50
Io[Note3]	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6,	1,2,4,5	dBm/ 9.36MHz	-56.28		(Io for Channel 3 +19.75dB)	-85.28
	NR_FDD_FR1_B						-84.78
	NR_TDD_FR1_C						-84.28
	NR_FDD_FR1_D, NR_TDD_FR1_D						-83.78
	NR_FDD_FR1_E, NR_TDD_FR1_E						-83.28
	NR_FDD_FR1_F						-82.78
	NR_FDD_FR1_G						-82.28
	NR_FDD_FR1_H						-81.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6,	3,6	dBm/ 38.16MHz	-50.19		(Io for Channel 3 +19.75dB)	-79.19
	NR_FDD_FR1_B						-78.69
	NR_TDD_FR1_C						-78.19
	NR_FDD_FR1_D, NR_TDD_FR1_D						-77.69
	NR_FDD_FR1_E, NR_TDD_FR1_E						-77.19
	NR_FDD_FR1_F						-76.69
	NR_FDD_FR1_G						-76.19
	NR_FDD_FR1_H						-75.69
$\hat{E}_s/N_{oc}$		1~6	dB	10	10	13	-3
Propagation condition		1~6	-	AWGN		AWGN	
Antenna configuration				1x2		1x2	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5 The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil the Absolute requirement in clause 10.1.4.1.1 and Relative requirement in clause 10.1.4.1.2.

A.4.7.1.3 Void

A.4.7.2 SS-RSRQ

A.4.7.2.1 EN-DC Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.7.1.1.

A.4.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in Table A.4.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in Table A.4.7.2.1.2-2. The configuration of cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.4.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.4.7.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter		**Unit**	**Test 1**		**Test 2**		**Test 3**	
			Cell 2	**Cell 3**	**Cell 2**	**Cell 3**	**Cell 2**	**Cell 3**
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52					
	Config 2,5		10: $N_{RB,c}$ = 52					
	Config 3,6		40: $N_{RB,c}$ = 106					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Control Channel RMC	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OP. 1					
SS-RSSI-Measurement			Not Applicable					
Time offset with Cell 2	Config 1,4	ms	-	3	-	3	-	3
	Config 2,3,5,6	µs	-	3	-	3	-	3
SMTC configuration	Config 1,4		SMTC.2					
	Config 2,3,5,6		SMTC.1					
SSB configuration	Config 1,2,4,5		SSB.1 FR1					
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz					
	Config 3,6		30kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								

N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/15kHz	-85		-101		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7		-91		-		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/SCS	-85		-101		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7		-88		-		-111	
		NR_FDD_FR1_B						-110.5	
		NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
$\hat{E}_s/I_{ot}$			dB	-1.76		-4.7		-5.46	-5.46
$\hat{E}_s/N_{oc}$			dB	3	3	-2.9	-2.9	-4	-4
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/SCS	-82	-82	-103.9	-103.9	-118	-118
		NR_FDD_FR1_B						-117.5	-117.5
		NR_TDD_FR1_C						-117	-117
		NR_FDD_FR1_D, NR_TDD_FR1_D						-116.5	-116.5

		NR_FDD_FR1_E, NR_TDD_FR1_E						-116	-116
		NR_FDD_FR1_F						-115.5	-115.5
		NR_FDD_FR1_G						-115	-115
		NR_FDD_FR1_H						-114.5	-114.5
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7		-85	-85	-	-	-115	-115
		NR_FDD_FR1_B						-114.5	-114.5
		NR_TDD_FR1_C						-114	-114
		NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5	-113.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-113	-113
		NR_FDD_FR1_F						-112.5	-112.5
		NR_FDD_FR1_G						-112	-112
		NR_FDD_FR1_H						-111.5	-111.5
SS-RSRQ Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dB	-14.77	-14.77	-16.76	-16.76	-17.34	-17.34
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D, NR_TDD_FR1_D							
		NR_FDD_FR1_E, NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/ 9.36MHz	-50		-70		-83.5	
		NR_FDD_FR1_B						-83	
		NR_TDD_FR1_C						-82.5	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-82	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-81.5	
		NR_FDD_FR1_F						-81	
		NR_FDD_FR1_G						-80.5	
		NR_FDD_FR1_H						-80	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 7	dBm/ 38.16MHz	-50		-		-77.4	
		NR_FDD_FR1_B						-76.9	
		NR_TDD_FR1_C						-76.4	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-75.9	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-75.4	
		NR_FDD_FR1_F						-74.9	
		NR_FDD_FR1_G						-74.4	
		NR_FDD_FR1_H						-73.9	
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5:	NR operating band groups are as defined in Clause 3.5.2.
Note 6:	Subtest 2 is not used when testing with 30kHz SSB SCS
Note 7:	The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.7.1.1.

A.4.7.2.2 EN-DC Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.1.1 and 10.1.9.1.2 for inter frequency measurement.

A.4.7.2.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.4.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in Table A.4.7.2.2.2-2. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1.

Table A.4.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.2.2.2-2: SS-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52					
	Config 2,5		10: $N_{RB,c}$ = 52					
	Config 3,6		40: $N_{RB,c}$ = 106					
BWP BW	Config 1,4	MHz	10: $N_{RB,c}$ = 52					
	Config 2,5		10: $N_{RB,c}$ = 52					
	Config 3,6		40: $N_{RB,c}$ = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OCNG pattern 1					
Time offset with Cell 2	Config 1,4	ms	-	3	-	3	-	3
	Config 2,3,5,6	μs	-	3	-	3	-	3
SMTC configuration	Config 1,4		SMTC pattern 2					
	Config 2,3,5,6		SMTC pattern 1					
SSB configuration	Config 1,2,4,5		SSB pattern 1 in FR1					
	Config 3,6		SSB pattern 2 in FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz					
	Config 3,6		30 kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0

EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/15kHz	-80.18	-80.18	-106	-106	-116	-116
		NR_FDD_FR1_B						-115.5	-115.5
		NR_TDD_FR1_C						-115	-115
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	-114.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	-114
		NR_FDD_FR1_G						-113	-113
		NR_FDD_FR1_H						-112.5	-112.5
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/15kHz	-86.27	-86.27	-113	-113	-116	-116
		NR_FDD_FR1_B						-115.5	-115.5
		NR_TDD_FR1_C						-115	-115
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	-114.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	-114
		NR_FDD_FR1_G						-113	-113
		NR_FDD_FR1_H						-112.5	-112.5
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/SCS	-80.18	-80.18	-106	-106	-116	-116
		NR_FDD_FR1_B						-115.5	-115.5
		NR_TDD_FR1_C						-115	-115
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	-114.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	-114
		NR_FDD_FR1_G						-113	-113
		NR_FDD_FR1_H						-112.5	-112.5
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A		-83.27	-83.27	-110	-110	-113	-113
		NR_FDD_FR1_B						-112.5	-112.5
		NR_TDD_FR1_C						-112	-112
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-111.5
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-111
		NR_FDD_FR1_G						-110	-110
		NR_FDD_FR1_H						-109.5	-109.5
$\hat{E}_s/I_{ot}$			dB	-1.75	-1.75	-1.75	-1.75	3	-1.75
$\hat{E}_s/N_{oc}$			dB	-1.75	-1.75	-1.75	-1.75	3	-1.75
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/SCS	-81.93	-81.93	-107.75	-107.75	-113	-117.75
		NR_FDD_FR1_B						-112.5	-117.25
		NR_TDD_FR1_C						-112	-116.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-116.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-115.75

		NR_FDD_FR1_G						-110	-114.75
		NR_FDD_FR1_H						-109.5	-114.25
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A		-85.02	-85.02	-111.75	-111.75	-110	-114.75
		NR_FDD_FR1_B						-109.5	-114.25
		NR_TDD_FR1_C						-109	-113.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-108.5	-113.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-108	-112.75
		NR_FDD_FR1_G						-107	-111.75
		NR_FDD_FR1_H						-106.5	-111.25
SS-RSRQ Note3		NR_FDD_FR1_A NR_TDD_FR1_A	dB	-14.77	-14.77	-40.59	-40.59	-12.56	-14.76
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/ 9.36MHz	-50	-50	-75.83	-75.83	-83.28	-85.83
		NR_FDD_FR1_B						-82.78	-85.33
		NR_TDD_FR1_C						-82.28	-84.83
		NR_FDD_FR1_D NR_TDD_FR1_D						-81.78	-84.33
		NR_FDD_FR1_E NR_TDD_FR1_E						-81.28	-83.83
		NR_FDD_FR1_G						-80.28	-82.83
		NR_FDD_FR1_H						-79.78	-82.33
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NR_SDL_FR1_A	dBm/ 38.16MHz	-50	-50	-76.73	-76.73	-77.19	-79.73
		NR_FDD_FR1_B						-76.69	-79.23
		NR_TDD_FR1_C						-76.19	-78.73
		NR_FDD_FR1_D NR_TDD_FR1_D						-75.69	-78.23
		NR_FDD_FR1_E NR_TDD_FR1_E						-75.19	-77.73
		NR_FDD_FR1_G						-74.19	-76.73
		NR_FDD_FR1_H						-73.69	-76.53
Propagation condition				AWGN	AWGN	AWGN	AWGN	AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Note 5: NR operating band groups are as defined in Clause 3.5.2.

A.4.7.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.9.1.1 and 10.1.9.1.2.

A.4.7.3 SS-SINR

A.4.7.3.1 EN-DC Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.12.1.1.

A.4.7.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in Table A.4.7.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in Table A.4.7.3.1.2-2. The configuration of cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.4.7.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1,4		FDD			
	Config 2,3,5,6		TDD			
TDD configuration	Config 1,4		Not Applicable			
	Config 2,5		TDDConf.1.1			
	Config 3,6		TDDConf.2.1			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
TRS Configuration	Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP.1			
SS-RSSI-Measurement			Not Applicable			
Time offset with Cell 2	Config 1,4	ms	-	3	-	3
	Config 2,3,5,6	µs	-	3	-	3
SMTC configuration	Config 1,4		SMTC.2			
	Config 2,3,5,6		SMTC.1			
SSB configuration	Config 1,2,4,5		SSB.1 FR1			
	Config 3,6		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15			
	Config 3,6		30			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15kHz	-93		-116	
	NR_FDD_FR1_B				-115.5	

		NR_TDD_FR1_C				-115	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-114.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-114	
		NR_FDD_FR1_F				-113.5	
		NR_FDD_FR1_G				-113	
		NR_FDD_FR1_H				-112.5	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-93		Same as Noc for 15kHz	
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-90		-113	
		NR_FDD_FR1_B				-112.5	
		NR_TDD_FR1_C				-112	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-111.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-111	
		NR_FDD_FR1_F				-110.5	
		NR_FDD_FR1_G				-110	
		NR_FDD_FR1_H				-109.5	
$\hat{E}_s/I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s/N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A	dBm/SCS	-88.46	-90.34	-120	-120
		NR_FDD_FR1_B				-119.5	-119.5
		NR_TDD_FR1_C				-119	-119
		NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5	-118.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-118	-118
		NR_FDD_FR1_F				-117.5	-117.5
		NR_FDD_FR1_G				-117	-117
		NR_FDD_FR1_H				-116.5	-116.5
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85.46	-87.34	-117	-117
		NR_FDD_FR1_B				-116.5	-116.5
		NR_TDD_FR1_C				-116	-116
		NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5	-115.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-115	-115
		NR_FDD_FR1_F				-114.5	-114.5
		NR_FDD_FR1_G				-114	-114
		NR_FDD_FR1_H				-113.5	-113.5
SS-SINR Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	0	-3.19	-5.46	-5.46
		NR_FDD_FR1_B					
		NR_TDD_FR1_C					
		NR_FDD_FR1_D, NR_TDD_FR1_D					
		NR_FDD_FR1_E, NR_TDD_FR1_E					
		NR_FDD_FR1_F					
		NR_FDD_FR1_G					

		NR_FDD_FR1_H			
Io[Note3]	Config 1,2,4,5	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36MHz	-57.5	-85.51
		NR_FDD_FR1_B			-85.01
		NR_TDD_FR1_C			-84.51
		NR_FDD_FR1_D, NR_TDD_FR1_D			-84.01
		NR_FDD_FR1_E, NR_TDD_FR1_E			-83.51
		NR_FDD_FR1_F			-83.01
		NR_FDD_FR1_G			-82.51
		NR_FDD_FR1_H			-82.01
	Config 3,6	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16MHz	-51.41	-79.41
		NR_FDD_FR1_B			-78.91
		NR_TDD_FR1_C			-78.41
		NR_FDD_FR1_D, NR_TDD_FR1_D			-77.91
		NR_FDD_FR1_E, NR_TDD_FR1_E			-77.41
		NR_FDD_FR1_F			-76.91
		NR_FDD_FR1_G			-76.41
		NR_FDD_FR1_H			-75.91
Propagation condition			-	AWGN	
Antenna configuration			-	1x2	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in Clause 3.5.2.
Note 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.12.1.1.

A.4.7.3.2 EN-DC Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.4.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.14.1.1 and 10.1.14.1.2 for interfrequency measurement.

A.4.7.3.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.4.7.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in Table

A.4.7.3.2.2-2. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell of which specific test parameters for this test case are specified in Table A.3.7.2.1-1.

Table A.4.7.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.3.2.2-2: SS-SINR Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 2	**Cell 3**	**Cell 2**	**Cell 3**	**Cell 2**	**Cell 3**
SSB ARFCN			**freq1**	**freq2**	**freq1**	**freq2**	**freq1**	**freq2**
Duplex mode	Config 1,4		FDD					
	Config 2,3,5,6		TDD					
TDD configuration	Config 1,4		Not Applicable					
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
DRX Cycle configuration		ms	Not Applicable					
Gap pattern ID			0	-	0	-	0	-
TRS configuration	Config 1,4		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2,5		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2,5		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3,6		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2,5		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3,6		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP.1					
SS-RSSI-Measurement			Not Applicable					
Time offset with Cell 2	Config 1,4	ms	-	3	-	3	-	3
	Config 2,3,5,6	µs	-	3	-	3	-	3
SMTC configuration	Config 1,4		SMTC.2					
	Config 2,3,5,6		SMTC.1					
SSB configuration	Config 1,2,4,5		SSB.1 FR1					
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15					
	Config 3,6		30					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								

EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-88	-108.5	-119.5
		NR_FDD_FR1_B				-119
		NR_TDD_FR1_C				-118.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-118
		NR_FDD_FR1_E NR_TDD_FR1_E				-117.5
		NR_FDD_FR1_F				-117
		NR_FDD_FR1_G				-116.5
		NR_FDD_FR1_H				-116
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-88	-108.5	Same as Noc for 15kHz
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85	-105.5	-116.5
		NR_FDD_FR1_B				-116
		NR_TDD_FR1_C				-115.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-115
		NR_FDD_FR1_E NR_TDD_FR1_E				-114.5
		NR_FDD_FR1_F				-114
		NR_FDD_FR1_G				-114.5
		NR_FDD_FR1_H				-113
$\hat{E}_s/I_{ot}$			dB	-1.75	20	-4.0
$\hat{E}_s/N_{oc}$			dB	-1.75	20	-4.0
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75	-88.5	-123.5
		NR_FDD_FR1_B				-123
		NR_TDD_FR1_C				-122.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-122
		NR_FDD_FR1_E NR_TDD_FR1_E				-121.5
		NR_FDD_FR1_F				-121
		NR_FDD_FR1_G				-120.5
		NR_FDD_FR1_H				-120
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75	-85.5	-120.5
		NR_FDD_FR1_B				-120
		NR_TDD_FR1_C				-119.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-119
		NR_FDD_FR1_E NR_TDD_FR1_E				-118.5
		NR_FDD_FR1_F				-118
		NR_FDD_FR1_G				-117.5
		NR_FDD_FR1_H				-117
SS-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75	20	-4.0
		NR_FDD_FR1_B				
		NR_TDD_FR1_C				

		NR_FDD_FR1_D NR_TDD_FR1_D				
		NR_FDD_FR1_E NR_TDD_FR1_E				
		NR_FDD_FR1_F				
		NR_FDD_FR1_G				
		NR_FDD_FR1_H				
Io[Note3]	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36MHz	-57.83	-60.5	-90.09
		NR_FDD_FR1_B				-89.59
		NR_TDD_FR1_C				-89.09
		NR_FDD_FR1_D NR_TDD_FR1_D				-88.59
		NR_FDD_FR1_E NR_TDD_FR1_E				-88.09
		NR_FDD_FR1_F				-87.59
		NR_FDD_FR1_G				-87.09
		NR_FDD_FR1_H				-86.59
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16MHz	-51.73	-54.41	-84
		NR_FDD_FR1_B				-83.5
		NR_TDD_FR1_C				-83
		NR_FDD_FR1_D NR_TDD_FR1_D				-82.5
		NR_FDD_FR1_E NR_TDD_FR1_E				-82
		NR_FDD_FR1_F				-81.5
		NR_FDD_FR1_G				-81
		NR_FDD_FR1_H				-80.5
Propagation condition			-	AWGN		
Antenna configuration			-	1x2		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in Clause 3.5.2.
Note 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.3.2.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.14.1.1 and 10.1.14.1.2.

A.4.7.4 L1-RSRP measurement for beam reporting

A.4.7.4.1 SSB based L1-RSRP measurement

A.4.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 9.5.2 and clause 10.1.19.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in Table A.4.7.4.1.1-1.

Table A.4.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.4.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.7.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.4.7.4.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.4.7.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2

SSB GSCN	1~6		freq1	freq1
Duplex mode	1,4		FDD	FDD
	2,5		TDD	TDD
	3,6		TDD	TDD
TDD Configuration	1,4		N/A	N/A
	2,5		TDDConf.1.1	TDDConf.1.1
	3,6		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
	2,5		10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
	3,6		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	SR.1.1 FDD
	2,5		SR.1.1 TDD	SR.1.1 TDD
	3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD	CR.1.1 FDD
	2,5		CR.1.1 TDD	CR.1.1 TDD
	3,6		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD	CCR.1.1 FDD
	2,5		CCR.1.1 TDD	CCR.1.1 TDD
	3,6		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1,4		SSB.3 FR1	SSB.3 FR1
	2,5		SSB.3 FR1	SSB.3 FR1
	3,6		SSB.4 FR1	SSB.4 FR1
OCNG Patterns	1~6		OP.1	OP.1
TRS configuration	1,4		TRS.1.1 FDD	TRS.1.1 FDD
	2,5		TRS.1.1 TDD	TRS.1.1 TDD
	3,6		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~6		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~6		SMTC.1	SMTC.1
reportConfigType	1~6		periodic	periodic
reportQuantity	1~6		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~6		2	2
L1-RSRP reporting period	1~6		slot80	slot80
EPRE ratio of PSS to SSS	1~6	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2 — NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15kHz	-94.65	-117
N_{oc} Note2 — NR_FDD_FR1_B				-116.5
N_{oc} Note2 — NR_TDD_FR1_C				-116

	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-94.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-91.65	-114
	NR_FDD_FR1_B				-113.5
	NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
$\hat{E}_s/I_{ot}$		1~6	dB	10	-3
SSB RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-84.65	-120
	NR_FDD_FR1_B				-119.5
	NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-81.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-56.28	-87.28

	NR_FDD_FR1_B				-86.78
	NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B				-80.69
	NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
$\hat{E}_s/N_{oc}$		1~6	dB	10	-3
Propagation condition		1~6		AWGN	AWGN
Antenna configuration		1~6		1x2	1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification					

A.4.7.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in clauses 10.1.19.1.

A.4.7.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.4.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 9.5.3 and clause 10.1.19.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in Table A.4.7.4.2.1-1.

Table A.4.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.4.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.7.4.2.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.4.7.4.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.4.7.4.2.2-1: FR1 CSI-RS based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2

SSB GSCN		1~6		freq1	freq1
Duplex mode		1,4		FDD	FDD
		2,5		TDD	TDD
		3,6		TDD	TDD
TDD Configuration		1,4		N/A	N/A
		2,5		TDDConf.1.1	TDDConf.1.1
		3,6		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$		1,4	MHz	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
		2,5		10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
		3,6		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel		1,4		SR.1.1 FDD	SR.1.1 FDD
		2,5		SR.1.1 TDD	SR.1.1 TDD
		3,6		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel		1,4		CR.1.1 FDD	CR.1.1 FDD
		2,5		CR.1.1 TDD	CR.1.1 TDD
		3,6		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel		1,4		CCR.1.1 FDD	CCR.1.1 FDD
		2,5		CCR.1.1 TDD	CCR.1.1 TDD
		3,6		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration		1,4		SSB.1 FR1	SSB.1 FR1
		2,5		SSB.1 FR1	SSB.1 FR1
		3,6		SSB.2 FR1	SSB.2 FR1
OCNG Patterns		1~6		OP.1	OP.1
TRS configuration		1,4		TRS.1.1 FDD	TRS.1.1 FDD
		2,5		TRS.1.1 TDD	TRS.1.1 TDD
		3,6		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration		1~6		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1~6		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1~6		SMTC.1	SMTC.1
CSI-RS		1,4		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
		2,5		CSI-RS 1.2 TDD	CSI-RS 1.2 TDD
		3,6		CSI-RS 2.2 TDD	CSI-RS 2.2 FDD
reportConfigType		1~6		periodic	periodic
reportQuantity		1~6		cri-RSRP	cri-RSRP
Number of reported RS		1~6		2	2
L1-RSRP reporting period		1~6		slot80	slot80
EPRE ratio of PSS to SSS		1~6	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15kHz	-94.65	-117

	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/CSI-RS SCS	-94.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-91.65	-114
	NR_FDD_FR1_B				-113.5
	NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
$\hat{E}_s/I_{ot}$		1~6	dB	10	10
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/CSI-RS SCS	-84.65	-120
	NR_FDD_FR1_B				-119.5
	NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-81.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5

Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B				-86.78
	NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B				-80.69
	NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
$\hat{E}_s / N_{oc}$		1~6	dB	10	-3
Propagation condition		1~6		AWGN	AWGN
Antenna configuration		1~6		1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.4.7.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 2 shall fulfil the requirements in clauses 10.1.19.2.

A.4.7.5 SFTD accuracy

A.4.7.5.1 SFTD accuracy

A.4.7.5.1.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the SFTD measurement accuracy is within the specified limits. This test will verify the requirements as specified in clause 9.1.27 in TS 36.133 [15] for EN-DC SFTD measurements.

A.4.7.5.1.2 Test Parameters

Supported test configurations are shown in Table A.4.7.5.1.2-1. In this set of test cases there are two cells on different carriers. Cell 1 is E-UTRAN PCell and Cell 2 is NR FR1 PSCell. The test parameters of cell 1 are given in clause A.3.7.2.1. The test parameters of cell 2 are given in Table A.4.7.5.1.2-2. The SFTD between PCell and PSCell shall be set by the test equipment to one of the time differences in Table A.4.7.5.1.2-3.

Table A.4.7.5.1.2-1: Supported test configurations for SFTD accuracy

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.4.7.5.1.2-2: Test parameters for SFTD accuracy

Parameter		Config	Unit	Test 1
SSB GSCN		1~6		freq1
Duplex mode		1,4		FDD
		2,5		TDD
		3,6		TDD
TDD Configuration		1,4		N/A
		2,5		TDDConf.1.1
		3,6		TDDConf.2.1
$BW_{channel}$		1,4	MHz	10: $N_{RB,c}$ = 52
		2,5		10: $N_{RB,c}$ = 52
		3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel		1,4		SR.1.1 FDD
		2,5		SR.1.1 TDD
		3,6		SR.2.1 TDD
RMSI CORESET Reference Channel		1,4		CR.1.1 FDD
		2,5		CR.1.1 TDD
		3,6		CR.2.1 TDD
RMC CORESET Reference Channel		1,4		CCR.1.1 FDD
		2,5		CCR.1.1 TDD
		3,6		CCR.2.1 TDD
SSB configuration		1,4		SSB.1 FR1
		2,5		SSB.1 FR1
		3,6		SSB.2 FR1
SMTC configuration		1~6		SMTC.1
DL BWP configuration		1~6		DLBWP.1.1
UL BWP configuration		1~6		ULBWP.1.1
OCNG Patterns		1~6		OP.1
EPRE ratio of PSS to SSS		1~6	dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15kHz	-104
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-104
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			

	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-101
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
$\hat{E}_s/I_{ot}$		1~6	dB	-3
$\hat{E}_s/N_{oc}$		1~6	dB	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SCS	-107
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-104
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-74.28
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-68.18
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			

	NR_FDD_FR1_H			
Propagation condition		1~6		AWGN
Antenna configuration		1~6		1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification				

Table A.4.7.5.1.2-3: Timing offsets for SFTD accuracy test

Configuration	SFN offset between PCell and PSCell	Frame boundary offset between PCell and PSCell (Ts)
1	100	-122000
2	300	-60540
3	500	1000
4	700	62540
5	900	124000

A.4.7.5.1.3 Test Requirements

The SFTD reported by the UE consists of 2 elements, SFN offset and frame boundary offset between PCell and PSCell. The reported SFTD accuracy shall fulfil the requirement in clause 9.1.27 in TS 36.133 [15].

A.4.7.5.2 Void

A.4.7.5.3 Void

A.4.7.6 CLI measurements

A.4.7.6.1 EN-DC SRS-RSRP measurement accuracy with FR1 serving cell

A.4.7.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.22.1.1 with the testing configurations for NR cells in Table A.4.7.6.1.1-1.

Table A.4.7.6.1.1-1: Applicable NR configurations for FR1 SRS-RSRP accuracy test

Config	Description
1	LTE FDD, NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 30kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
3	LTE TDD, NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.6.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.7.6.1.2-1 below. The test parameter for the (virtual) neighbor cell UE transmitting SRS are given in Table A.4.7.6.1.2-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in Table A.4.7.6.1.2-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 1 data symbol before SRS to be transmitted.

Table A.4.7.6.1.2-1: FR1 test parameters for SRS-RSRP accuracy for PSCell

Parameter		Config	Unit	Test 1	Test 2	Test 3
SSB GSCN		1~4		freq1	freq1	freq1
Duplex mode		1~4		TDD	TDD	TDD
TDD configuration		1,3		TDDConf.1.1	TDDConf.1.1	TDDConf.1.1
		2,4		TDDConf.2.1	TDDConf.2.1	TDDConf.2.1
$BW_{channel}$		1,3	MHz	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
		2,4		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel		1,3		SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD
		2,4		SR.2.1 TDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel		1,3		CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD
		2,4		CR.2.1 TDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel		1,3		CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD
		2,4		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration		1,3		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
		2,4		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
OCNG Patterns		1~4		OP.1	OP.1	OP.1
TRS configuration		1,3		TRS.1.1 TDD	TRS.1.1 TDD	TRS.1.1 TDD
		2,4		TRS.1.2 TDD	TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration		1~4		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1~4		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1~4		SMTC.1	SMTC.1	SMTC.1
Time offset between DL from serving cell and SRS from test system		1~4	µs	17.67	17.67	17.67
EPRE ratio of PSS to SSS		1~4	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc} Note2	NR_TDD_FR1_A Note3	1,3	dBm/15kHz	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A Note3	2,4		Not applicable Note4	-91	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
N_{oc} Note2	NR_TDD_FR1_A Note3	1,3	dBm/SRS SCS	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5

	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A Note3	2,4		Not applicable Note4	-88	-111
	NR_TDD_FR1_C					-110
	NR_TDD_FR1_D					-109.5
	NR_TDD_FR1_E					-109

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification
Note 4: Test 1 is not used when testing with 30kHz SSB SCS

Table A.4.7.6.1.2-2: FR1 test parameters for SRS-RSRP accuracy for neighbour cell UE

Parameter		Config	Unit	Test 1	Test 2	Test 3
N_{oc} Note2	NR_TDD_FR1_A NOTE 3	1,3	dBm/15kHz	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 5	2,4		Not applicable Note 6	-91	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
N_{oc} Note2	NR_TDD_FR1_A NOTE 5	1,3	dBm/SRS SCS	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 5	2,4		Not applicable Note 6	-88	-111
	NR_TDD_FR1_C					-110
	NR_TDD_FR1_D					-109.5
	NR_TDD_FR1_E					-109
$\hat{E}_s/I_{ot}$ on SRS		1~4	dB	1	1	1
SRS RSRP Note3	NR_TDD_FR1_A NOTE 5	1,3	dBm/SRS SCS	-105	-87	-113
	NR_TDD_FR1_C					-112
	NR_TDD_FR1_D					-111.5
	NR_TDD_FR1_E					-111
	NR_TDD_FR1_A NOTE 5	2,4		Not applicable Note 6	-87	-110
	NR_TDD_FR1_C					-109
	NR_TDD_FR1_D					-108.5
	NR_TDD_FR1_E					-108
Io Note3	NR_TDD_FR1_A NOTE 5	1,3	dBm/9.36 MHz	-74.51	-56.51	-82.51
	NR_TDD_FR1_C					-81.51
	NR_TDD_FR1_D					-81.01
	NR_TDD_FR1_E					-79.51
	NR_TDD_FR1_A NOTE 5	2,4	dBm/38.16 MHz	Not applicable Note 6	-53.42	-76.42
	NR_TDD_FR1_C					-75.42
	NR_TDD_FR1_D					-74.92
	NR_TDD_FR1_E					-74.42
$\hat{E}_s/N_{oc}$ on SRS		1~4	dB	1	1	1
Propagation condition		1~4		AWGN	AWGN	AWGN
Antenna configuration		1~4		1x2	1x2	1x2
SRS configuration		1,3		SRSConf.1	SRSConf.1	SRSConf.1
		2,4		SRSConf.2	SRSConf.2	SRSConf.2

Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of the test.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5:	The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification
Note 6:	Test 1 is not used when testing with 30kHz SSB SCS

Table A.4.7.6.1.2-3: SRS configuration parameters for FR1 SRS-RSRP accuracy

	Field	SRSConf.1	SRSConf.2
SRS-ResourceSet	srs-ResourceSetId	0	0
	srs-ResourceIdList	0	0
	resourceType	Periodic	Periodic
	Usage	Codebook	Codebook
SRS-Resource	SRS-ResourceId	0	0
	nrofSRS-Ports	Port1	Port1
	transmissionComb	n2	n2
	combOffset-n2	0	0
	cyclicShift-n2	0	0
	resourceMapping startPosition	0	0
	resourceMapping nrofSymbols	n1	n1
	resourceMapping repetitionFactor	n1	n1
	freqDomainPosition	0	0
	freqDomainShift	0	0
	freqHopping c-SRS	12	12
	freqHopping b-SRS	0	0
	freqHopping b-hop	0	0
	groupOrSequenceHopping	Neither	Neither
	resourceType	Periodic	Periodic
	periodicityAndOffset-p	sl20, 9	sl40, 19
	sequenceId	0	0

A.4.7.6.1.3 Test Requirements

The SRS-RSRP measurement accuracy shall fulfil the requirements in clauses 10.1.22.1.1.

A.4.7.6.2 EN-DC CLI-RSSI measurement accuracy with FR1 serving cell

A.4.7.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CLI-RSSI measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.22.2.1 with the testing configurations for NR cells in Table A.4.7.6.2.1-1.

Table A.4.7.6.2.1-1: Applicable NR configurations for FR1 CLI-RSSI accuracy test

Config	Description
1	LTE FDD, NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 30kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
3	LTE TDD, NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 30kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.4.7.6.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.4.7.6.2.2-1 below.

Before the test UE is configured to perform CLI-RSSI measurement. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI resource and on 1 data symbol before. The CLI-RSSI measurement resource configuration is in Table A.4.7.6.2.2-2.

Table A.4.7.6.2.2-1: FR1 test parameters for CLI-RSSI accuracy

Parameter	Config	Unit	Value
SSB GSCN	1~4		freq1
Duplex mode	1~4		TDD
TDD configuration	1,3		TDDConf.1.1
	2,4		TDDConf.2.1
$BW_{channel}$	1,3	MHz	10: $N_{RB,c}$ = 52
	2,4		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1,3		SR.1.1 TDD
	2,4		SR.2.1 TDD
RMSI CORESET Reference Channel	1,3		CR.1.1 TDD
	2,4		CR.2.1 TDD
Dedicated CORESET Reference Channel	1,3		CCR.1.1 TDD
	2,4		CCR.2.1 TDD
SSB configuration	1,3		SSB.1 FR1
	2,4		SSB.2 FR1
OCNG Patterns Note6	1~4		OP.1
TRS configuration	1,3		TRS.1.1 TDD
	2,4		TRS.1.2 TDD
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~4		SMTC.1
Time offset between DL from serving cell and OCNG from test system	1~4	µs	17.67
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} on CLI-RSSI measurement resource Note2	1,3	dBm/15kHz	-106
	2,4		-106
N_{oc} on CLI-RSSI measurement resource Note2	1,3	dBm/ BWP SCS	-106
	2,4		-103
$\hat{E}_s/I_{ot}$ on CLI-RSSI measurement resource	1~4	dB	-Infinity
RSRP on CLI-RSSI measurement resource Note3	1~4	dBm/ BWP SCS	-Infinity
Io on CLI-RSSI measurement resource Note3	1,3	dBm/9.36 MHz	-78.05

	2,4	dBm/38.16 MHz	-71.96
Io on CLI-RSSI measurement resource Note3	1,3	dBm/1.08 MHz	-87.43
	2,4		-87.44
$\hat{E}_s/N_{oc}$ on CLI-RSSI measurement resource	1~4	dB	-Infinity
Propagation condition	1~4		AWGN
Antenna configuration	1~4		1x2

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification
Note 6: OCNG is not transmitted in the CLI-RSSI measurement resources.

Table A.4.7.6.2.2-2: CLI-RSSI measurement resource configuration for FR1 CLI-RSSI accuracy

	Field	Config	SRSConf.1
CLI-RSSI measurement resource	rssi-ResourceId	1~4	0
	rssi-SCS	1,3	15kHz
		2,4	30kHz
	startPRB	1~4	0
	nrofPRBs	1,3	52
		2,4	106
	startPosition	1~4	3
	nrofSymbols	1~4	11
	rssi-PeriodicityAndOffset	1,3	sl20, 9
		2,4	sl40, 19

A.4.7.6.2.3 Test Requirements

The CLI-RSSI measurement accuracy shall fulfil the requirements in clauses 10.1.22.2.1.

A.4.8 Void

A.5 EN-DC tests with one or more NR cells in FR2

A.5.1 Void

A.5.2 Void

A.5.3 RRC_CONNECTED state mobility

A.5.3.1 Void

A.5.3.2 RRC Connection Mobility Control

A.5.3.2.1 Void

A.5.3.2.2 Random Access

A.5.3.2.2.1 Contention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in Table A.5.3.2.2.1.1-1. UE capable of EN-DC with PSCell or SCell in FR2 needs to be tested by using the parameters in Table A.5.3.2.2.1.1-2 and Table A.5.3.2.2.1.1-3.

Table A.5.3.2.2.1.1-1: Supported test configurations for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Config	Description
1	LTE FDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.5.3.2.2.1.1-2: General test parameters for contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1,2		SSB.1 FR2	As defined in A.3.10
Duplex Mode for Cell 2	Config 1,2		TDD	
TDD Configuration	Config 1,2		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{RB,c}$ = 24	
OCNG Pattern Note 1			OP.3	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1,2		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	As defined in A.3.1.2
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
PRACH Configuration			FR2 PRACH configuration 1	As defined in A.3.8.3, with exceptions as defined below.
rsrp-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

Note 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6dBm/SCS applied, *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.

Note 4: The Δ_{DL} value is calculated as ($RSRP\_{REP}$ – RSRP_76), where $RSRP\_{REP}$ is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.5.3.2.2.1.1-3: OTA-related test parameters for contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams[Note 3]			Rough	
SSB with index 0	Es [Note1]	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es [Note1]	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	AWGN	
Note 1: No articial noise is applied in this test. Note 2: Void. Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.5.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in Clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB.*

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received

Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.5.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in Clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A.5.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in Clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.5.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in Clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.5.3.2.2.2 4-step RA type non-contention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.2 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in Table A.5.3.2.2.2.1-1. UE capable of EN-DC withPSCell or SCell in FR2 needs to be tested by using the parameters in Table A.5.3.2.2.2.1-2 and Table A.5.3.2.2.2.1-3 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.5.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Config	Description
1	LTE FDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.5.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

<table>
<tr><th colspan="2">Parameter</th><th>Unit</th><th>Test-1</th><th>Test-2</th><th>Comments</th></tr>
<tr><td>SSB Configuration</td><td>Config 1,2</td><td></td><td>SSB.1 FR2</td><td>SSB.1 FR2</td><td>As defined in A.3.10</td></tr>
<tr><td>CSI-RS Configuration</td><td>Config 1,2</td><td></td><td>N/A</td><td>CSI-RS.3.1 TDD</td><td>As defined in A.3.1.4</td></tr>
<tr><td>Duplex Mode for Cell 2</td><td>Config 1,2</td><td></td><td>TDD</td><td>TDD</td><td></td></tr>
<tr><td>TDD Configuration</td><td>Config 1,2</td><td></td><td>TDDConf.3.1</td><td>TDDConf.3.1</td><td></td></tr>
<tr><td>$BW_{channel}$</td><td>Config 1,2</td><td>MHz</td><td>100: $N_{RB,c}$ = 24</td><td>100: $N_{RB,c}$ = 24</td><td></td></tr>
<tr><td colspan="2">OCNG Pattern Note 1</td><td></td><td>OCNG pattern 1</td><td>OCNG pattern 1</td><td>As defined in A.3.2.1.</td></tr>
<tr><td>PDSCH Reference Channel Note 2</td><td>Config 1,2</td><td></td><td>SR3.1 TDD</td><td>SR3.1 TDD</td><td>As defined in A.3.1.1.</td></tr>
<tr><td>RMSI CORESET Reference Channel</td><td>Config 1,2</td><td></td><td>CR.3.1 TDD</td><td>CR.3.1 TDD</td><td>As defined in A.3.1.2</td></tr>
<tr><td colspan="2">NR RF Channel Number</td><td></td><td>1</td><td>1</td><td></td></tr>
<tr><td colspan="2">EPRE ratio of PSS to SSS</td><td>dB</td><td rowspan="7">0</td><td rowspan="7">0</td><td></td></tr>
<tr><td colspan="2">EPRE ratio of PBCH_DMRS to SSS</td><td>dB</td><td></td></tr>
<tr><td colspan="2">EPRE ratio of PBCH to PBCH_DMRS</td><td>dB</td><td></td></tr>
<tr><td colspan="2">EPRE ratio of PDCCH_DMRS to SSS</td><td>dB</td><td></td></tr>
<tr><td colspan="2">EPRE ratio of PDCCH to PDCCH_DMRS</td><td>dB</td><td></td></tr>
<tr><td colspan="2">EPRE ratio of PDSCH_DMRS to SSS</td><td>dB</td><td></td></tr>
<tr><td colspan="2">EPRE ratio of PDSCH to PDSCH_DMRS</td><td>dB</td><td></td></tr>
<tr><td colspan="2">ss-PBCH-BlockPower</td><td>dBm/ SCS</td><td>+20 +Δ_{UL}</td><td>+20 +Δ_{UL}</td><td>As defined in TS 38.331 [2].
Δ_{UL} is derived from the uplink calibration process Note 3</td></tr>
<tr><td colspan="2">Configured UE transmitted power ($P_{CMAX, f, c}$)</td><td>dBm</td><td>maximum value configurable for certain power class</td><td>maximum value configurable for certain power class</td><td>As defined in clause 6.2.4 in TS 38.101-2 [19]</td></tr>
<tr><td colspan="2">PRACH Configuration</td><td></td><td>FR2 PRACH configuration 1</td><td>FR2 PRACH configuration 1</td><td>As defined in A.3.8.3, with exceptions as defined below</td></tr>
<tr><td colspan="2">rsrp-ThresholdSSB</td><td>dBm</td><td>RSRP_69 +Δ_{DL}</td><td>RSRP_69 +Δ_{DL}</td><td>RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process Note 4</td></tr>
<tr><td colspan="2">preambleReceivedTargetPower</td><td>dBm</td><td>-100</td><td>-100</td><td>As defined in TS 38.331 [2]</td></tr>
<tr><td colspan="6">Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.
Note 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6dBm/SCS applied, preambleReceivedTargetPower = -100dBm and ss-PBCH-BlockPower = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.
Note 4: The Δ_{DL} value is calculated as (RSRP_$_{REP}$ – RSRP_76), where RSRP_$_{REP}$ is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.</td></tr>
</table>

Table A.5.3.2.2.2.1-3: OTA-related test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Test-2	Comments
AoA setup			Setup 1	Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 3			Rough	Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	-80.6	
	Es/Iot_{BB}	dB	21.09	21.09	
	Io	dBm/95.04 MHz	-56.01	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	-95.0	
	Es/Iot_{BB}	dB	6.69	6.69	
	Io	dBm/95.04 MHz	-70.41	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	AWGN	AWGN	
Note 1: No articial noise is applied in this test. Note 2: void. Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation					

A.5.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.5.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in Clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.3 2-step RA type contention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in Table A.5.3.2.2.3.1-1. UE capable of EN-DC with PSCell or SCell in FR2 needs to be tested by using the parameters in Table A.5.3.2.2.3.1-2 and Table A.5.3.2.2.3.1-3.

Table A.5.3.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access test in FR2 for PSCell/SCell in EN-DC

Config	Description
1	LTE FDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.5.3.2.2.3.1-2: General test parameters for 2-step RA type contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1,2		SSB.1 FR2	As defined in A.3.10
Duplex Mode for Cell 2	Config 1,2		TDD	
TDD Configuration	Config 1,2		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: NRB,c = 24	
OCNG Pattern Note 1			OP.3	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1,2		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	As defined in A.3.1.2
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +ΔUL	As defined in TS 38.331 [2]. ΔUL is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX, f, c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration			FR2 MsgA configuration 1	As defined in A.3.20.3.1, with exceptions as defined below.
msgA-RSRP-ThresholdSSB		dBm	RSRP_69 +ΔDL	RSRP_69 corresponds to -88dBm. ΔDL is derived from the downlink calibration process Note 4
msgA-PreambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

Note 3: The Δ_{UL} value is calculated as -ROUND(P_{MsgA0} -1), where P_{MsgA0} is the measured first MsgA PRACH power with -80.6dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA.

Note 4: The Δ_{DL} value is calculated as (RSRP_$_{REP}$ – RSRP_76), where RSRP_$_{REP}$ is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.5.3.2.2.3.1-3: OTA-related test parameters for 2-step RA type contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 2			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	AWGN	
Note 1: No artificial noise is applied in this test. Note 2: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.3.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.5.3.2.2.3.2.1 MsgA Transmission

To test the UE behaviour specified in Clause 6.2.2.3.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA preamble transmission shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA PRACH and MsgA PUSCH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.3.2.2 MsgB Reception

To test the UE behaviour specified in Clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB with successRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit an ACK if the MsgB with a successRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble and if the Contention Resolution is successful.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgBs contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA preamble transmission shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.3.2.3 No MsgB Reception

To test the UE behaviour specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB with successRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the RA Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA preamble transmission shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA PRACH and MsgA PUSCH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.4 2-step RA type SSB based non-contention based random access test in FR2 for PSCell/SCell in EN-DC

A.5.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the MsgA power settings and timing are within specified limits. This test will verify the requirements in clause 6.2.2.3 and clause 7.1.2 in an AWGN model.

For this test two cells are used, with the configuration of Cell 1 (E-UTRA PCell) specified in clause A.3.7.2.1 and Cell 2 configured as PSCell or SCell in FR2. Supported test parameters are shown in Table A.5.3.2.2.4.1-1. UE capable of EN-DC with PSCell or SCell in FR2 needs to be tested by using the parameters in Table A.5.3.2.2.4.1-2 and Table A.5.3.2.2.4.1-3 for SSB-based non-contention based random access test.

Table A.5.3.2.2.4.1-1: Supported test configurations for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Config	Description
1	LTE TDD, NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.5.3.2.2.4.1-2: General test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 FR2	As defined in A.3.10
Duplex Mode for Cell 2	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{RB,c}$ = 24	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	As defined in A.3.1.2
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX, f, c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration			FR2 MsgA configuration 2	As defined in A.3.20.3.2, with exceptions as defined below
msgA-*RSRP-ThresholdSSB*		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

Note 3: The Δ_{UL} value is calculated as -ROUND(P_{MsgA0} -1), where P_{MsgA0} is the measured first MsgA PRACH power with -80.6dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA.

Note 4: The Δ_{DL} value is calculated as ($RSRP\_{REP}$ – RSRP_76), where $RSRP\_{REP}$ is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.5.3.2.2.4.1-3: OTA-related test parameters for non-contention based random access test in FR2 for PSCell/SCell in EN-DC

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 2			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured msgA-*RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured msgA-*RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	AWGN	
Note 1: No articial noise is applied in this test. Note 2: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.5.3.2.2.4.2.1 MsgA Transmission

To test the UE behavior specified in Clause 6.2.2.3.2.1, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA PRACH on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.4.2.3 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a fallbackRAR MAC subPDU.

The UE shall fallback to the 4-step RA type by transmitting the msg3 containing the payload of MsgA PUSCH and monitoring contention resolution as described in clause 8.2A in TS 38.213 [3].

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA and msg3 transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.2.4.2.4 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.5.3.2.3 Void

A.5.4 Timing

A.5.4.1 UE transmit timing

A.5.4.1.1 NR UE Transmit Timing Test for FR2

A.5.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in Table 5.4.1.1.1-1.

Table A.5.4.1.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
2	LTE TDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz

The test consists of E-UTRA PCell and NR PSCell. The configuration for E-UTRA is given in A.3.7.2.1. Tables A.5.4.1.1.1-2 and A.5.4.1.1.1-2A define the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.5.4.1.1.1-3.

Table A.5.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2	Band Group

SSB ARFCN		1,2	Freq1	Freq1	
Duplex Mode		1,2	TDD		
TDD configuration		1,2	TDDConf.3.1		
$BW_{channel}$	MHz	1,2	100: $N_{RB,c}$ = 66		
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1		
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1		
TRS Configuration		1,2	TRS.2.1 TDD		
TCI State		1,2	CSI-RS.Config.0		
DRx Cycle	ms	1,2	N/A	DRX.8 Note5	
PDSCH Reference measurement channel		1,2	SR.3.1 TDD		
CORESET Reference Channel		1,2	CR.3.1 TDD		
OCNG Patterns		1,2	OCNG pattern 1		
SSB Configuration		1,2	SSB.4 FR2		
SMTC Configuration		1,2	SMTC.1		
PDSCH/PDCCH subcarrier spacing	kHz	1,2	120		
EPRE ratio of PSS to SSS	dB	1,2	0	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
Propagation condition		1,2	AWGN		
SRS Config		1,2	SRSConf.1 Note6	SRSConf.2 Note6	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: DRx related parameters are given in Table A.3.3.8-1
Note 6: SRS configs are given in Table A.5.4.1.1.1-3

Table A.5.4.1.1.1-2A: OTA related test parameters

Parameter	Unit	Test 1	Test 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 6		Fine	
N_{oc} Note1	dBm/15kHz Note4	-112	
N_{oc} Note1	dBm/SCS Note3	-103	
$\hat{E}_s/N_{oc}$	dB	4	
SS-RSRP Note2	dBm/SCS Note4	-99	
$\hat{E}_s/I_{ot}$	dB	4	
Io Note2	dBm/95.04 MHz Note4	-68.5	
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

Table A.5.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	17	17	Matches $N_{RB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset-p	sl1,0	sl2560,4	Offset to align with DRx periodicity
	sequenceId	0	0	Any 10 bit number

Table A.5.4.1.1.1-4: Void

A.5.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up E-UTRA PCell according to parameters given in Table A.3.7.2.2-1 and setup NR PSCell according to parameters given in Table A.5.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.

   a. The N_{TA} offset value (in T_c units) is 13792

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.5.4.1.1.2-1

Table A.5.4.1.1.2-1 Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
240	$+8*64T_c$	$+4*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment

A.5.4.2 UE timer accuracy

A.5.4.3 Timing advance

A.5.4.3.1 EN-DC FR2 timing advance adjustment accuracy

A.5.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.5.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.5.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.5.4.3.1.2-2, A.5.4.3.1.2-3, A.5.4.3.1.2-3A and A.5.4.3.1.2-4. The configuration of Cell 1 (LTE PCell) is specified in clause A.3.7.2.1.

In all test cases, two cells are used. Cell 1 is the PCell in the primary Timing Advance Group (pTAG) and cell 2 is the PSCell is in the secondary Timing Advance Group (sTAG). Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands for sTAG are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.5.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured for PSCell in sTAG.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element for sTAG, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance for sTAG used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements for sTAG, with Timing Advance Command value specified in table A.5.4.3.1.2-2. This value shall result in changes of the timing advance for sTAG used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in clause 5.2 in TS 38.321, shall be configured so that it does not expire in the duration of the test.

Table A.5.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		Cell 1: 1 Cell 2: 2	1 for E-UTRAN PCell 2 for NR PSCell
Initial DL BWP		DLBWP.0.1	As specified in Table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in Table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in Table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in Table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA\_new} = N_{TA\_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	*For 120 kHz SCS* $N_{TA\_new} = N_{TA\_old} + 1024*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.5.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter	Unit	Test1	
		T1	T2
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	
BWP BW	MHz	100: $N_{RB,c}$ = 66	
DRx Cycle	ms	Not Applicable	
PDSCH Reference measurement channel		SR.3.1 TDD	
CORESET Reference Channel		CR.3.1 TDD	
TRS configuration		TRS.2.1 TDD	
TCI configuration		CSI-RS.Config.0	
OCNG Patterns		OCNG pattern 1	
SMTC configuration		SMTC.1 FR2	
SSB configuration		SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing	kHz	120 kHz	
PUCCH/PUSCH subcarrier spacing	kHz	120 kHz	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation condition	-	AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.4.3.1.2-3A: OTA related test parameters

Parameter	Unit	Test 1	
		T1	T2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 6		Fine	
N_{oc} Note1	dBm/15kHz Note4	-112	
N_{oc} Note1	dBm/SCS Note3	-103	
$\hat{E}_s/N_{oc}$	dB	4	
SS-RSRP Note2	dBm/SCS Note4	-99	
$\hat{E}_s/I_{ot}$	dB	4	
Io Note2	dBm/95.04 MHz Note4	-68.5	
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

Table A.5.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field	Value	Comment
c-SRS	16	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=4	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.5.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value for PSCell in sTAG to the transmission timing at the designated activation time i.e. $k+1$ slots after the reception of the timing advance command, where $k = 11$.

The Timing Advance adjustment accuracy for PSCell in sTAG shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

A.5.5 Signaling characteristics

A.5.5.1 Radio link Monitoring

In the following clause, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

Editor note: The metric for the detection of the UE UL transmitted signal by the TE is FFS.

A.5.5.1.1 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS in non-DRX mode

A.5.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.1.1-1. The test parameters are given in Tables A.5.5.1.1.1-2, A.5.5.1.1.1-3, and A. 5.5.1.1.1-4 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.5.5.1.1.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 1.

Table A.5.5.1.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.1.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 2		TDD
$BW_{channel}$	Config 1, 2		100: $N_{RB,c}$ = 66
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
TDD Configuration	Config 1, 2		TDDConf.3.1
CORESET Reference Channel	Config 1, 2		CR.3.1 TDD
SSB Configuration	Config 1, 2		SSB.1 FR2
SMTC Configuration	Config 1, 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz
PRACH Configuration	Config 1, 2		Table A.3.8.3.4
SSB index assigned as RLM RS	Config 1, 2		0,1
OCNG parameters			OP.2
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD
T1		s	0.2
T2		s	9.68
T3		s	9.68
D1		s	9.64
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.1.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 3 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams[Note 5]			Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0					
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1, 2	dB	2[Note 6]	-6[Note 6]	-15			
ssb-Index 1 SNR	Config 1, 2		Not sent			2[Note 6]	-15	-15
SNR on other channels and signals	Config 1, 2	dB	2[Note 6]			N/A		
N_{oc}	Config 1, 2	dBm/15kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in Figure A.5.5.1.1.1-2					
Propagation condition			TDL-A 30ns 75Hz			TDL-A 30ns 75Hz		
Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG. Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs. Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband								

Table A.5.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0
Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap).	

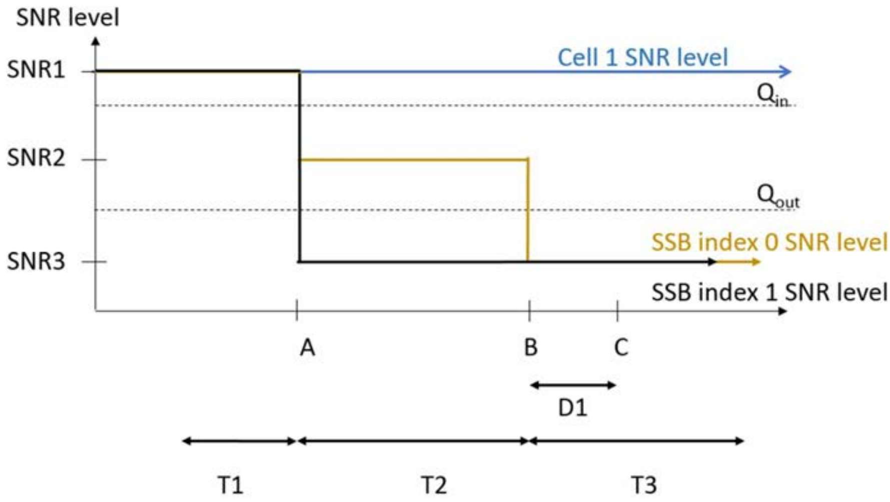


Figure A.5.5.1.1.1-1: SNR variation for out-of-sync testing

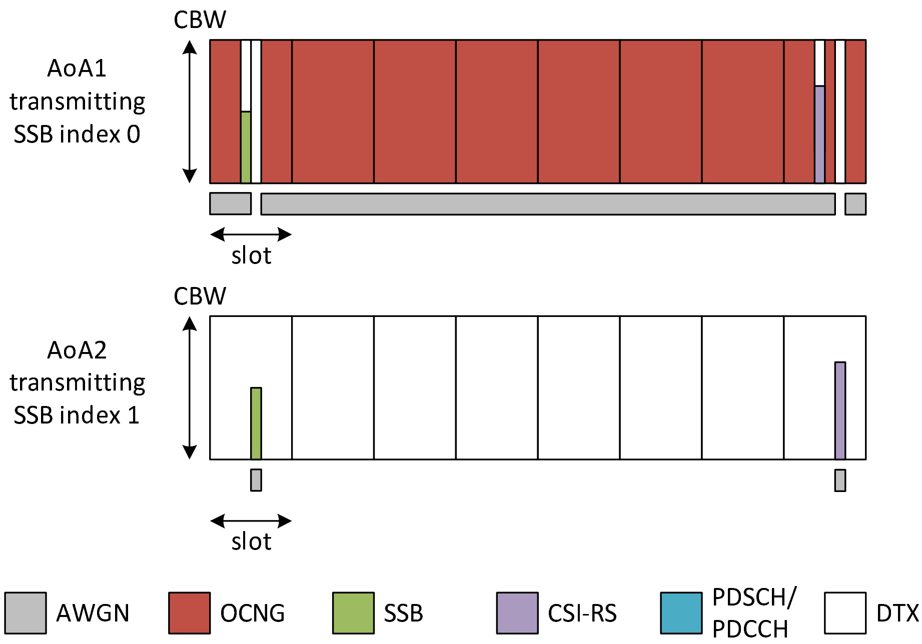


Figure A.5.5.1.1.1-2: Time multiplexed downlink transmissions

A.5.5.1.1.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.1.2 Radio Link Monitoring In-sync Test for FR2 PSCell configured with SSB-based RLM RS in non-DRX mode

A.5.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.2.1-1. The test parameters are given in Tables A.5.5.1.2.1-2, and A.5.5.1.2.1-3 below. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.5.5.1.2.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5ms.

Table A.5.5.1.2.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.2.1-2: General test parameters for FR2 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Ce1l 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 2		TDD
$BW_{channel}$	Config 1, 2		100: $N_{RB,c}$ = 66
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
TDD Configuration	Config 1, 2		TDDConf.3.1
CORESET Reference Channel	Config 1, 2		CR.3.1 TDD
SSB Configuration	Config 1, 2		SSB.1 FR2
SMTC Configuration	Config 1, 2		SMTC.3
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz
PRACH Configuration	Config 1, 2		Table A.3.8.3.4

SSB index assigned as RLM RS	Config 1, 2		0,1
OCNG parameters			OP.2
CP length			Normal
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	4000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	1.88
T4		s	0.2
T5		s	3.84
D1		s	3.8
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.2.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for in-sync radio link monitoring tests in non-DRX mode

<table>
<tr><th colspan="2" rowspan="2">Parameter</th><th rowspan="2">Unit</th><th colspan="10">Test 1</th></tr>
<tr><th>T1</th><th>T2</th><th>T3</th><th>T4</th><th>T5</th><th>T1</th><th>T2</th><th>T3</th><th>T4</th><th>T5</th></tr>
<tr><td colspan="2" rowspan="2">AoA setup</td><td rowspan="2"></td><td colspan="10">Setup 3 defined in A.3.15</td></tr>
<tr><td colspan="5">AoA1</td><td colspan="5">AoA2</td></tr>
<tr><td colspan="2">Assumption for UE beams[Note 5]</td><td></td><td colspan="5">Rough</td><td colspan="5">Rough</td></tr>
<tr><td colspan="2">EPRE ratio of PDCCH DMRS to SSS</td><td>dB</td><td colspan="5">4</td><td colspan="5" rowspan="10">Not sent</td></tr>
<tr><td colspan="2">EPRE ratio of PDCCH to PDCCH DMRS</td><td>dB</td><td colspan="5" rowspan="8">0</td></tr>
<tr><td colspan="2">EPRE ratio of PBCH DMRS to SSS</td><td>dB</td></tr>
<tr><td colspan="2">EPRE ratio of PBCH to PBCH DMRS</td><td>dB</td></tr>
<tr><td colspan="2">EPRE ratio of PSS to SSS</td><td>dB</td></tr>
<tr><td colspan="2">EPRE ratio of PDSCH DMRS to SSS</td><td>dB</td></tr>
<tr><td colspan="2">EPRE ratio of PDSCH to PDSCH DMRS</td><td>dB</td></tr>
<tr><td colspan="2">EPRE ratio of OCNG DMRS to SSS</td><td>dB</td></tr>
<tr><td colspan="2">EPRE ratio of OCNG to OCNG DMRS</td><td>dB</td></tr>
<tr><td>ssb-Index 0 SNR</td><td>Config 1, 2</td><td>dB</td><td>2[Note 6]</td><td>-6[Note 6]</td><td>-15</td><td>-4.5</td><td>2[Note 6]</td></tr>
<tr><td>ssb-Index 1 SNR</td><td>Config 1, 2</td><td></td><td colspan="5">Not sent</td><td>2[Note 6]</td><td>-15</td><td>-15</td><td>-15</td><td>-15</td></tr>
<tr><td>SNR on other channels and signals</td><td>Config 1, 2</td><td>dB</td><td colspan="5">2</td><td colspan="5">N/A</td></tr>
<tr><td>N_{oc}</td><td>Config 1, 2</td><td>dBm/15KHz</td><td colspan="5">-92.1</td><td colspan="5">-92.1</td></tr>
<tr><td colspan="2">Time multiplexing of the downlink transmissions from each AoA</td><td></td><td colspan="10">Defined in Figure A.5.5.1.2.1-2</td></tr>
<tr><td colspan="2">Propagation condition</td><td></td><td colspan="5">TDL-A 30ns 75Hz</td><td colspan="5">TDL-A 30ns 75Hz</td></tr>
<tr><td colspan="13">Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband</td></tr>
</table>

Table A.5.5.1.2.1-4: Void

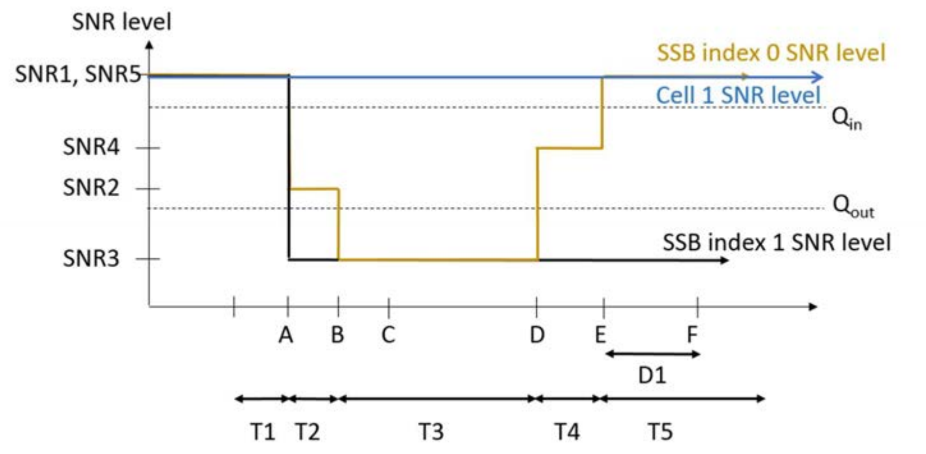


Figure A.5.5.1.2.1-1: SNR variation for in-sync testing

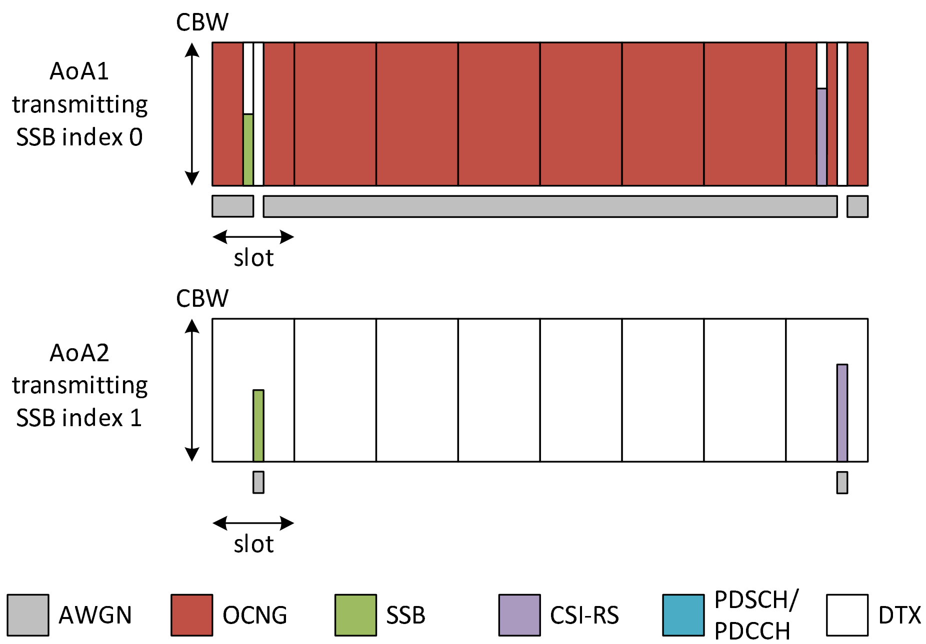


Figure A.5.5.1.2.1-2: Time multiplexed downlink transmissions

A.5.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.1.3 Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with SSB-based RLM RS in DRX mode

A.5.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.3.1-1. The test parameters are given in Tables A.5.5.1.3.1-2, and A.5.5.1.3.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.5.5.1.3.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.3.1-2: General test parameters for FR2 out-of-sync testing in DRX mode

<table>
<tr><th colspan="3" rowspan="2">Parameter</th><th rowspan="2">Unit</th><th>Value</th></tr>
<tr><th>Test 1</th></tr>
<tr><td colspan="3">Active E-UTRA PCell</td><td></td><td>Cell 1</td></tr>
<tr><td colspan="3">E-UTRA RF Channel Number</td><td></td><td>1</td></tr>
<tr><td colspan="3">Active PSCell</td><td></td><td>Cell 2</td></tr>
<tr><td colspan="3">RF Channel Number</td><td></td><td>2</td></tr>
<tr><td colspan="2">Duplex mode</td><td>Config 1, 2</td><td></td><td>TDD</td></tr>
<tr><td colspan="2">$BW_{channel}$</td><td>Config 1, 2</td><td></td><td>100: $N_{RB,c}$ = 66</td></tr>
<tr><td colspan="2">DL initial BWP configuration</td><td>Config 1, 2</td><td></td><td>DLBWP.0.1</td></tr>
<tr><td colspan="2">DL dedicated BWP configuration</td><td>Config 1, 2</td><td></td><td>DLBWP.1.1</td></tr>
<tr><td colspan="2">UL initial BWP configuration</td><td>Config 1, 2</td><td></td><td>ULBWP.0.1</td></tr>
<tr><td colspan="2">UL dedicated BWP configuration</td><td>Config 1, 2</td><td></td><td>ULBWP.1.1</td></tr>
<tr><td colspan="2">TDD Configuration</td><td>Config 1, 2</td><td></td><td>TDDConf.3.1</td></tr>
<tr><td colspan="2">CORESET Reference Channel</td><td>Config 1, 2</td><td></td><td>CR.3.1 TDD</td></tr>
<tr><td colspan="2">SSB Configuration</td><td>Config 1, 2</td><td></td><td>SSB.1 FR2</td></tr>
<tr><td colspan="2">SMTC Configuration</td><td>Config 1, 2</td><td></td><td>SMTC.1</td></tr>
<tr><td colspan="2">PDSCH/PDCCH subcarrier spacing</td><td>Config 1, 2</td><td></td><td>120 KHz</td></tr>
<tr><td colspan="2">PRACH Configuration</td><td>Config 1, 2</td><td></td><td>Table A.3.8.3.4</td></tr>
<tr><td colspan="2">SSB index assigned as RLM RS</td><td>Config 1, 2</td><td></td><td>0,1</td></tr>
<tr><td colspan="3">OCNG parameters</td><td></td><td>OP.1</td></tr>
<tr><td colspan="3">CP length</td><td></td><td>Normal</td></tr>
<tr><td rowspan="7">Out of sync transmission parameters</td><td colspan="2">DCI format</td><td></td><td>1-0</td></tr>
<tr><td colspan="2">Number of Control OFDM symbols</td><td></td><td>2</td></tr>
<tr><td colspan="2">Aggregation level</td><td>CCE</td><td>8</td></tr>
<tr><td colspan="2">Ratio of hypothetical PDCCH RE energy to average SSS RE energy</td><td>dB</td><td>4</td></tr>
<tr><td colspan="2">Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy</td><td>dB</td><td>4</td></tr>
<tr><td colspan="2">DMRS precoder granularity</td><td></td><td>REG bundle size</td></tr>
<tr><td colspan="2">REG bundle size</td><td></td><td>6</td></tr>
<tr><td colspan="3">DRX Configuration</td><td></td><td>DRX.3</td></tr>
<tr><td colspan="3">Gap pattern ID</td><td></td><td>N.A.</td></tr>
<tr><td colspan="3">Layer 3 filtering</td><td></td><td>Enabled</td></tr>
<tr><td colspan="3">T310 timer</td><td>ms</td><td>0</td></tr>
<tr><td colspan="3">T311 timer</td><td>ms</td><td>1000</td></tr>
<tr><td colspan="3">N310</td><td></td><td>1</td></tr>
<tr><td colspan="3">N311</td><td></td><td>1</td></tr>
<tr><td colspan="2">CSI-RS for CSI reporting</td><td>Config 1, 2</td><td></td><td>CSI-RS.3.1 TDD</td></tr>
<tr><td colspan="3">TCI states for PDCCH/PDSCH</td><td></td><td>TCI.State.2</td></tr>
<tr><td colspan="2">CSI-RS for tracking</td><td>Config 1, 2</td><td></td><td>TRS.2.1 TDD</td></tr>
<tr><td colspan="3">T1</td><td>s</td><td>0.2</td></tr>
<tr><td colspan="3">T2</td><td>s</td><td>14.48</td></tr>
<tr><td colspan="3">T3</td><td>s</td><td>14.48</td></tr>
<tr><td colspan="3">D1</td><td>s</td><td>14.44</td></tr>
<tr><td colspan="5">Note 1: All configurations are assigned to the UE prior to the start of time period T1.
Note 2: UE-specific PDCCH is not transmitted after T1 starts.
Note 3: E-UTRAN is in non-DRX mode under test.</td></tr>
</table>

Table A.5.5.1.3.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup			Setup 1 defined in A.3.15		
Assumption for UE beams Note 5			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
ssb-Index 0 SNR	Config 1, 2	dB	2 Note 6	-6 Note 6	-15
ssb-Index 1 SNR	Config 1, 2		2 Note 6	-15	-15
SNR on other channels and signals	Config 1, 2	dB	2 Note 6		
N_{oc}	Config 1, 2	dBm/15KHz	-104.7dBm		
Propagation condition			TDL-A 30ns 75Hz		

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband

Table A.5.5.1.3.1-4: Void

Table A.5.5.1.3.1-5: Void

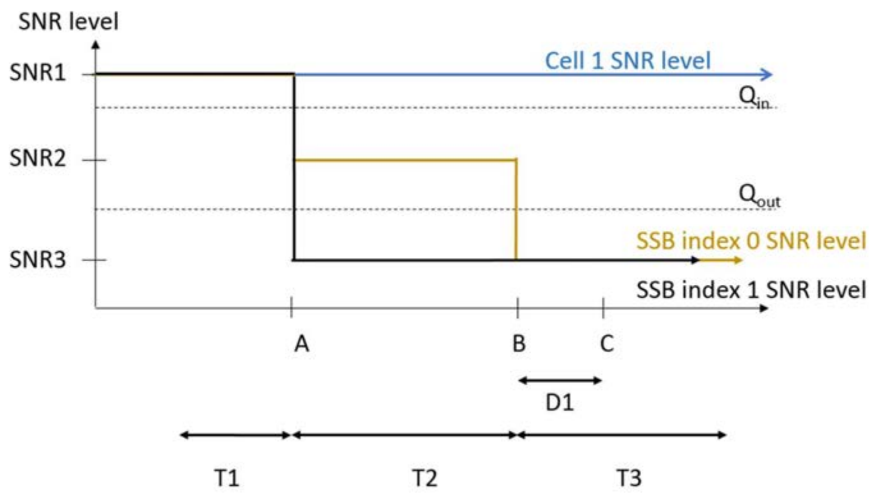


Figure A.5.5.1.3.1-1: SNR variation for out-of-sync testing

A.5.5.1.3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal in Cell 2 no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.1.4 Radio Link Monitoring In-sync Test for FR2 PSCell configured with SSB-based RLM RS in DRX mode

A.5.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PSCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.5.5.1.4.1-1. The test parameters are given in Tables A.5.5.1.4.1-2, and A.5.5.1.4.1-3. There are two cells, Cell 1 is the E-UTRAN PCell, and Cell 2 is the PSCell, in the test. The E-UTRAN PCell setting refers to Table A.3.7.2.1-2. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1 and Cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.5.5.1.4.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	FDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, NR 120 KHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.4.1-2: General test parameters for FR2 in-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex mode	Config 1, 2		TDD
$BW_{channel}$	Config 1, 2		100: $N_{RB,c}$ = 66
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
TDD Configuration	Config 1, 2		TDDConf.3.1
CORESET Reference Channel	Config 1, 2		CR.3.1 TDD
SSB Configuration	Config 1, 2		SSB.1 FR2
SMTC Configuration	Config 1, 2		SMTC.3
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz
PRACH Configuration	Config 1, 2		Table A.3.8.3.4
SSB index assigned as RLM RS	Config 1, 2		0,1
OCNG parameters			OP.1
CP length			Normal
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.11
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	4000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	2.8
T4		s	0.2

T5	s	3.88
D1	s	3.84
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts. Note 3: E-UTRAN is in non-DRX mode under test.		

Table A.5.5.1.4.1-3: OTA related cell specific test parameters for FR2 (Cell 2) for in-sync radio link monitoring test in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 5]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	4				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
ssb-Index 0 SNR	Config 1, 2	dB	2[Note 6]	-6[Note 6]	-15	-4.5	2[Note 6]
ssb-Index 1 SNR	Config 1, 2		2[Note 6]	-15	-15	-15	-15
SNR on other channels and signals	Config 1, 2	dB	2[Note 6]				
N_{oc}	Config 1, 2	dBm/15KHz	-104.7dBm				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.3
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband

Table A.5.5.1.4.1-4: Void

Table A.5.5.1.4.1-5: Void

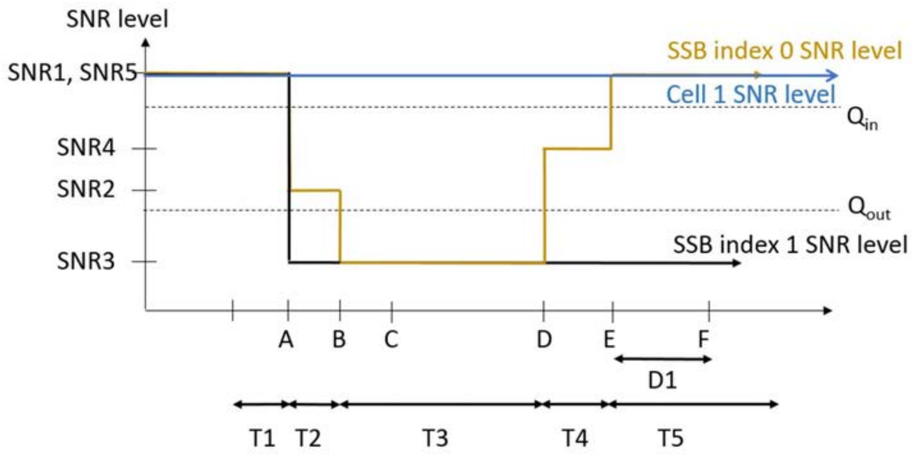


Figure A.5.5.1.4.1-1: SNR variation for in-sync testing.

A.5.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.1.5 EN-DC Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with CSI-RS-based RLM in non-DRX mode

A.5.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.5.1-1, A.5.5.1.5.1-2, A.5.5.1.5.1-3 and A.5.5.1.5.1-3A below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.5.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms). In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.5.5.1.5.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.5.1-2: General test parameters for FR2 PSCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex Mode			TDD
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMC CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
	Config 2		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
T1		s	0.2

T2	s	0.35
T3	s	0.35
D1	s	0.31
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.		

Table A.5.5.1.5.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 3 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams Note 10			Rough			Rough		
PDCCH_beta		dB	4			Not sent		
PDCCH_DMRS_beta		dB	4					
PBCH_beta		dB	0					
PSS_beta		dB						
SSS_beta		dB						
PDSCH_beta		dB						
OCNG_beta		dB						
SNR on RLM-RS1	Config 1, 2	dB	2 Note 11	-6 Note 11	-15			
SNR on RLM-RS2	Config 1, 2		Not sent			2 Note 11	-14	-15
SNR on other channels and signals	Config 1, 2	dB	2 Note 11			N/A		
N_{oc}	Config 1, 2	dBm/15kHz	-92.1			-92.1		
Propagation condition			TDL-A 30ns 75Hz			TDL-A 30ns 75Hz		

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.1.5.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband

Table A.5.5.1.5.1-3A: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap)	

Table A.5.5.1.5.1-4: Void

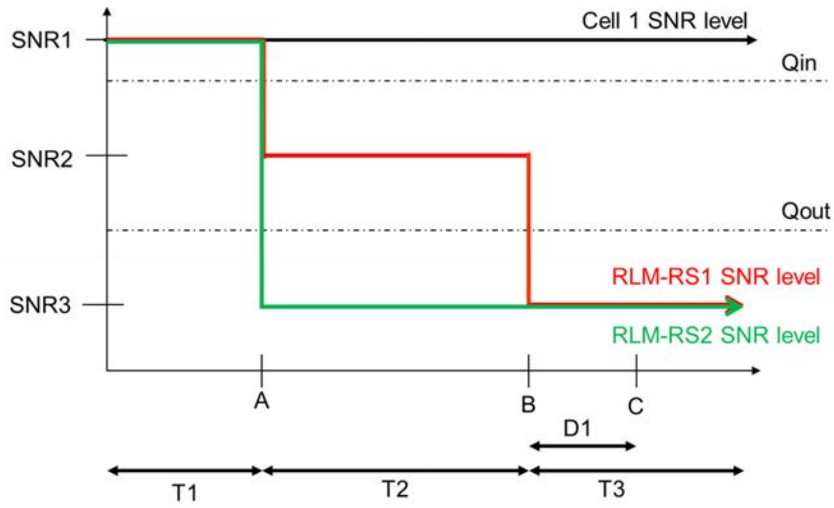


Figure A.5.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.5.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C (D_1 after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.1.6 EN-DC Radio Link Monitoring In-sync Test for FR2 PSCell configured with CSI-RS-based RLM in non-DRX mode

A.5.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.6.1-1, A.5.5.1.6.1-2, and A.5.5.1.6.1-3 below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.6.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.5.5.1.6.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.6.1-2: General test parameters for FR2 PSCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex Mode			TDD
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMC CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
	Config 2		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
OCNG parameters			OP.1
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0

	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.6.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1									
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
AoA setup			Setup 3 defined in A.3.15									
			AoA1					AoA2				
Assumption for UE beams Note 10			Rough					Rough				
PDCCH_beta		dB	4					Not sent				
PDCCH_DMRS_beta		dB	4									
PBCH_beta		dB	0									
PSS_beta		dB										
SSS_beta		dB										
PDSCH_beta		dB										
OCNG_beta		dB										
SNR on RLM-RS1	Config 1, 2	dB	2 Note 11	-6 Note 11	-15	-4.5	2 Note 11					
SNR on RLM-RS2	Config 1, 2		Not sent					2 Note 11	-14	-15	-15	-14
SNR on other channels and signals	Config 1, 2	dB	2					N/A				
N_{oc}	Config 1, 2	dBm/15KHz	-92.1					-92.1				
Propagation condition			TDL-A 30ns 75Hz					TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.5.5.1.6.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband

Table A.5.5.1.6.1-3A: Void

Table A.5.5.1.6.1-4: Void

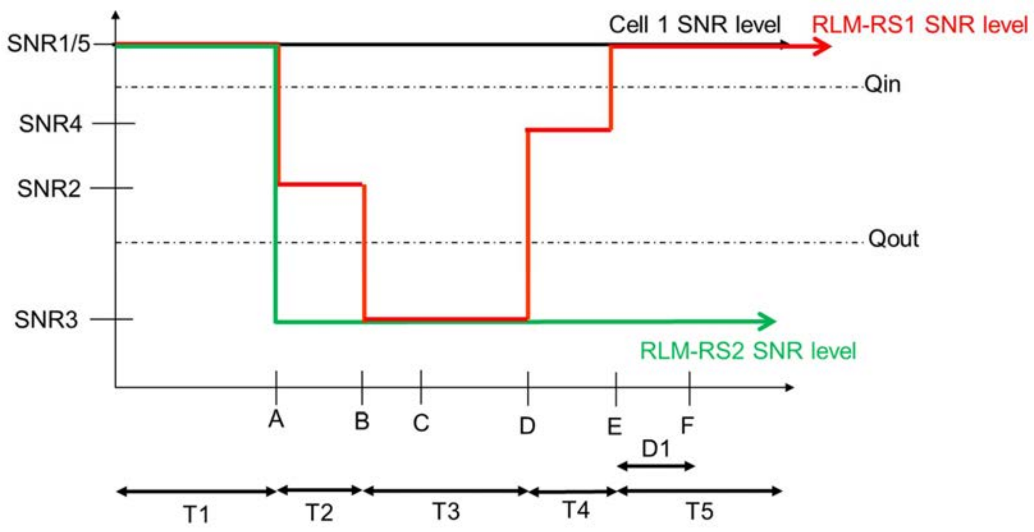


Figure A.5.5.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.5.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.1.7 EN-DC Radio Link Monitoring Out-of-sync Test for FR2 PSCell configured with CSI-RS-based RLM in DRX mode

A.5.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.7.1-1, A.5.5.1.7.1-2, and A.5.5.1.7.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.5.5.1.7.1-1 shows the variation of the downlink SNR in the E-UTRAN PCell and the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is enabled in PSCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.5.5.1.7.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.7.1-2: General test parameters for FR2 PSCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex Mode			TDD
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMC CORESET Reference Channel	Config 1		CCR. 3.1 TDD CCR.3.3 TDD
	Config 2		CCR. 3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*

T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.7.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup			Setup 1 defined in A.3.15		
Assumption for UE beams Note 10			Rough		
PDCCH_beta		dB	4		
PDCCH_DMRS_beta		dB	4		
PBCH_beta		dB	0		
PSS_beta		dB			
SSS_beta		dB			
PDSCH_beta		dB			
OCNG_beta		dB			
SNR on RLM-RS1	Config 1, 2	dB	2 Note 11	-6 Note 11	-15
SNR on RLM-RS2	Config 1, 2		2 Note 11	-14	-15
SNR on other channels and signals	Config 1, 2	dB	2 Note 11		
N_{oc}	Config 1	dBm/15KHz	-104.7		
	Config 2		-104.7		
Propagation condition			DL-A 30ns 75Hz		
Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1. Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs. Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.1.7.1-1. Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation. Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband.					

Table A.5.5.1.7.1-3A: Void

Table A.5.5.1.7.1-4: Void

Table A.5.5.1.7.1-5: Void

Table A.5.5.1.7.1-6: Void

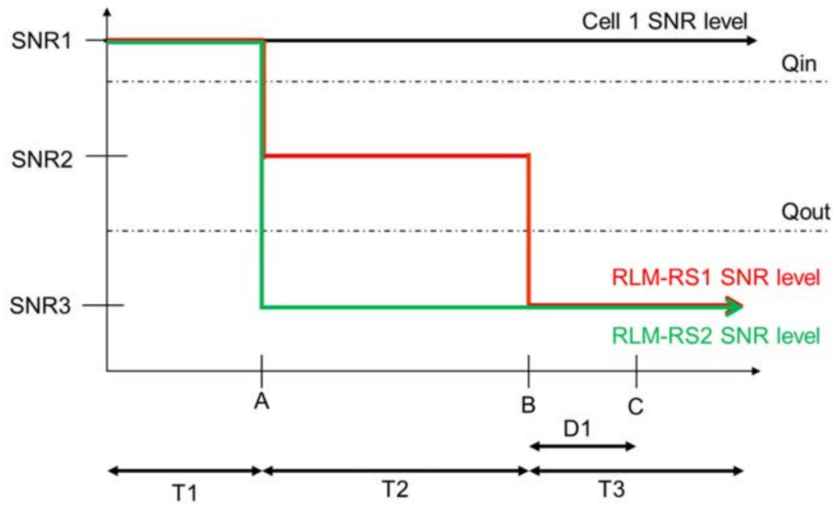


Figure A.5.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.5.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 2 (PSCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 2.

The UE shall stop transmitting uplink signal in Cell 2 (PSCell) no later than time point C (D_1 after the start of the time duration T3) on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.1.8 EN-DC Radio Link Monitoring In-sync Test for FR2 PSCell configured with CSI-RS-based RLM in DRX mode

A.5.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PSCell when no DRX is used. This test will partly verify the FR2 TDD PSCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.5.5.1.8.1-1, A.5.5.1.8.1-2, A.5.5.1.8.1-3 and A.5.5.1.8.1-3A below. There are two cells, cell 1which is the E-UTRAN PCell, and cell 2 is the NR PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.1.8.1-1 shows the variation of the downlink SNR in the PSCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms). In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.5.5.1.8.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.1.8.1-2: General test parameters for FR2 PSCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active E-UTRA PCell			Cell 1
E-UTRA RF Channel Number			1
Active PSCell			Cell 2
RF Channel Number			2
Duplex Mode			TDD
TDD Configuration	Config 1		TDDConf.3.1
	Config 2		TDDConf.3.1
DL initial BWP configuration	Config 1, 2		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1
UL initial BWP configuration	Config 1, 2		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1
RMCCORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
	Config 2		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
	Config 2		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
	Config 2		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
	Config 2		120 KHz
CSI-RS for RLM	Config 1, 2		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			CI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission	DCI format		1-0

parameters	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			*gp0*
v			
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
	Config 2		CSI-RS.3.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	1.64
T4		s	0.2
T5		s	1.88
D1		s	1.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts. Note 2: E-UTRAN is in non-DRX mode under test.			

Table A.5.5.1.8.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
PDCCH_beta		dB	4				
PDCCH_DMRS_beta		dB	4				
PBCH_beta		dB	0				
PSS_beta		dB					
SSS_beta		dB					
PDSCH_beta		dB					
OCNG_beta		dB					
SNR on RLM-RS1	Config 1, 2	dB	2 Note 11	-6 Note 11	-15	-4.5	2 Note 11
SNR on RLM-RS2	Config 1, 2	dB	2 Note 11	-14	-15	-15	-14
SNR on other channels and signals	Config 1, 2	dB	2 Note 11				
N_{oc}	Config 1, 2	dBm/15KHz	-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 2 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.5.5.1.8.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband

Table A.5.5.1.8.1-3A: Measurement gap configuration for FR2 CSI-RS in-sync radio link monitoring in DRX mode

Field	Test 1
	Value
gapOffset	0

Note 1: E-UTRAN PCell and PSCell are SFN-synchronous and frame boundary aligned. (Ensure that RLM RS is partially overlapped with measurement gap)

Table A.5.5.1.8.1-4: Void

Table A.5.5.1.8.1-5: Void

Table A.5.5.1.8.1-6: Void

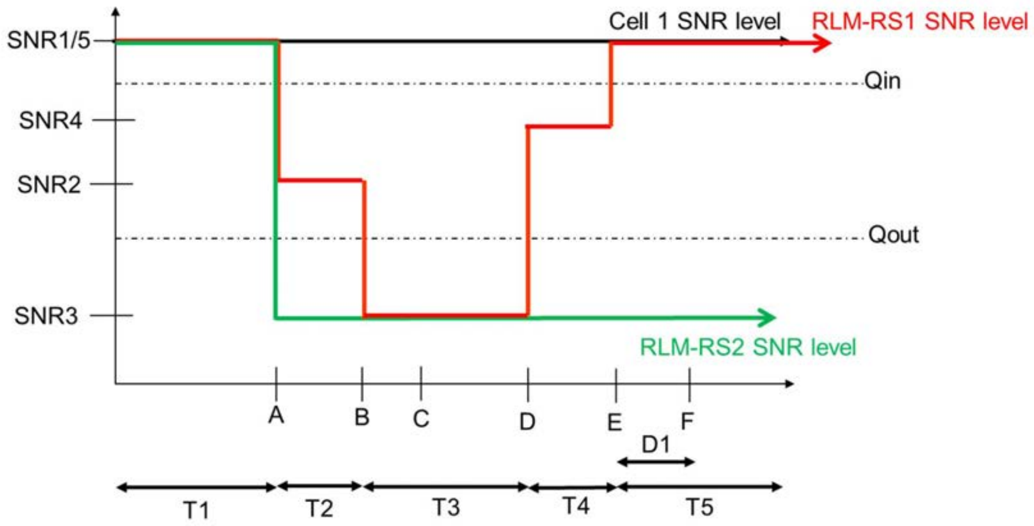


Figure A.5.5.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.5.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PSCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.1.9 EN-DC Radio Link Monitoring UE Scheduling Restrictions on FR2

A.5.5.1.9.1 Test Purpose and Environment

The purpose is to verify that the NR UE correctly follows the RLM scheduling restrictions requirements defined in clause 8.1.7. This test verifies that the UE correctly receive the PDCCH scheduled on the symbols right before the RLM SSB symbols without overlap so that it sends ACK/NACK correctly. The test case is only applicable to UE which supports pdcch-MonitoringAnyOccasions or pdcch-MonitoringAnyOccasionsWithSpanGap.

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and NR FR2 PSCell (Cell 2). The test parameters for NR PSCell are given in table A.5.5.1.9.1-1, table A.5.5.1.9.1-2 and table A.5.5.1.9.1-3 below and the parameters and applicability for the E-UTRAN cell are defined in A.3.7.2. The UE is required during time period T1 to transmit ACK/NACK correctly upon scheduling of PDSCH.

Table A.5.5.1.9.1-1: Supported test configurations

Configuration	Description
1	FDD LTE, 120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE, 120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.5.5.1.9.1-2: General test parameters for RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		1, 2	1 and 2	1 for NR PSCell and 2 for LTE PCell
SSB configuration		1, 2	SSB.1 FR2	
SMTC configuration		1, 2	SMTC pattern 1	
DRX cycle length	s	1, 2	OFF	
T1	s	1, 2	5	During T1 the UE is required to correctly transmit ACK/NACK

Table A.5.5.1.9.1-3: Cell specific test parameters for RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Cell 2	
AoA setup		1, 2	Setup 3 defined in A.3.15.3	
			AoA1	**AoA2**
Assumption for UE beams[Note 1]			Rough	Rough
TDD configuration		1, 2	TDDConf.3.1	
PDSCH RMC configuration		1, 2	SR.3.1 TDD	Not sent
RMSI CORESET RMC configuration		1, 2	CR.3.1	Not sent
Dedicated CORESET RMC configuration		1, 2	CCR.3.2	Not sent
TRS configuration		1, 2	TRS.2.1 TDD	TRS.2.2 TDD
PDCCH/PDSCH TCI state		1, 2	TCI.State.2	Not sent
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1	Not sent
Initial DL BWP configuration		1, 2	DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1	
RLM-RS		1, 2	SSB with index 0	SSB with index 1
$\hat{E}_s/I_{ot}$	dB	1, 2	3	N/A
N_{oc} Note2	dBm/SCS	1, 2	-84.9	Not sent
$\hat{E}_s/N_{oc}$	dB	1, 2	3	N/A
SS-RSRP Note3	dBm/SCS	1, 2	-81.9	-81.9
Io	dBm/95.04 MHz	1, 2	-51.15	-52.91
Propagation Condition		1, 2	AWGN	-
Note 1: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.5.1.9.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.1.7.3.

A.5.5.2 Interruption

A.5.5.2.1 E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

A.5.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that when E-UTRA PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.1.1-1.

The general test parameters are given in Table A.5.5.2.1.1-2, and NR cell specific test parameters are given in Table A.5.5.2.1.1-3 and A.5.5.2.1.1-4. The E-UTRAN PCell DRX configuration parameters are given in Table A.5.5.2.1.1-5 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.2-1. In the test there are two cells: Cell1 and Cell2. Cell1 is LTE PCell on and Cell2 is NR FR2 PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. PDCCH indicating a new transmission on PSCell shall be sent continuously during the entire time duration to ensure UE would not enter DRX state on PSCell.

Table A.5.5.2.1.1-1: Interruption at transitions between active and non-active during DRX supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.1.1-2: General test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to cell1 and cell 2
DRX		DRX.4	DRX related parameters are defined in Table A.3.3.4-1
Measurement gap pattern Id		OFF	
T1	s	10	

Table A.5.5.2.1.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,c}$ = 66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration	Config 1,2		SMTC.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
$\hat{E}_s/N_{oc}$		dB	17
Propagation Condition			AWGN
Time offset to cell1 Note 2		µs	3
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table A.5.5.2.1.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in synchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note1	dBm/15kHz Note4	-112
N_{oc} Note1	dBm/SCS Note3	-102.97
$\hat{E}_s/N_{oc}$	dB	17
SS-RSRP Note2	dBm/SCS Note4	-85.97
$\hat{E}_s/I_{ot}$	dB	17
Io Note2	dBm/95.04 MHz Note4	-56.90
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation		

Table A.5.5.2.1.1-5: Void

A.5.5.2.1.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625ms (5 slots) as defined in clause 8. 2.1.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.2.2 E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

A.5.5.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that when LTE PCell is in DRX and NR PSCell is in non-DRX, NR PSCell interruptions due to transitions from active to non-active and from non-active to active during LTE PCell DRX the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.2.1-1.

The general test parameters are given in Table A.5.5.2.2.1-2, and NR cell specific test parameters are given in Table A.5.5.2.2.1-3 and A.5.5.2.2.1-4. The E-UTRAN PCell DRX configuration parameters are given in Table

A.5.5.2.2.1-5 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.2-1. In the test there are two cells: Cell1 and Cell2. Cell1 is LTE PCell and Cell2 is NR PSCell. The test consists of one time period, with duration of T1. During T1, NR PSCell is continuously scheduled in DL while LTE PCell is not scheduled and has DRX configured. Prior to the start of the time duration T1, Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. Prior to start of T1 the DRX inactivity timer for the LTE PCell has already expired. During T1 the UE shall be continuously scheduled on NR PSCell while not scheduled on LTE PCell. PDCCH indicating a new transmission on PSCell shall be sent continuously during the entire time duration to ensure UE would not enter DRX state on PSCell.

Table A.5.5.2.2.1-1: Interruption at transitions between active and non-active during DRX supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.2.1-2: General test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	One is E-UTRAN RF channel and the other is NR RF channel
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
CP length		Normal	Applicable to cell1 and cell 2
DRX		DRX.6	DRX related parameters are defined in Table A.3.3.6-1
Measurement gap pattern Id		OFF	
T1	s	10	

Table A.5.5.2.2.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,c}$ = 66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
RMC CORESET Reference Channel	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration	Config 1,2		SMTC.1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
$\hat{E}_s/N_{oc}$		dB	17
Propagation Condition			AWGN
Time offset to cell1 Note 2		ms	3
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table A.5.5.2.2.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions at transitions between active and non-active during DRX in asynchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note1	dBm/15kHz Note4	-112
N_{oc} Note1	dBm/SCS Note3	-102.97
$\hat{E}_s/N_{oc}$	dB	17
SS-RSRP Note2	dBm/SCS Note4	-85.97
$\hat{E}_s/I_{ot}$	dB	17
Io Note2	dBm/95.04 MHz Note4	-56.90
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation		

Table A.5.5.2.2.1-5: Void

A.5.5.2.2.2 Test Requirements

The UE shall be continuously scheduled in NR PSCell during the entire length of T1. UE shall not be scheduled in LTE PCell during T1. During the time duration T1 the UE shall transmit at least 99% of ACK/NACK on NR PSCell.

Interruption on NR PSCell shall not exceed 0.625ms (5 slots) as defined in clause 8. 2.1.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.2.3 E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

A.5.5.2.3.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.3.1-1.

The general test parameters are given in Table A.5.5.2.3.1-2, and NR cell specific test parameters are given in Table A.5.5.2.3.1-3 and A.5.5.2.3.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-2. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 is LTE PCell, Cell2 and Cell 3 is NR FR2 PSCell and NR FR2 deactivated SCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to

Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* for the deactivated NR SCells is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.5.5.2.3.1-1: Interruption during measurements on deactivated NR SCC supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.3.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 3.
CP length		Normal	Applicable to cell1, cell 2 and cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	Ms	640	
T1	S	10	

Table A.5.5.2.3.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR2	FR2
Duplex mode	Config 1,2		TDD	TDD
TDD configuration	Config 1,2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1	DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1	DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1	ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1	ULBWP.1.1
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD	-
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR 3.1 TDD	CCR 3.1 TDD
OCNG Patterns			OP.1	OP.1
SSB Configuration	Config 1,2		SSB.1 FR2	SSB.1 FR2
SMTC Configuration	Config 1,2		SMTC.1	SMTC.1
TRS configuration	Config 1,2		TRS.2.1 TDD	TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0	TCI.State.0
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition			AWGN	AWGN
Time offset to cell1 Note 2		μs	3	3
Time offset to cell1 Note 3		μs	-	3
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells Note 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells				

Table A.5.5.2.3.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in synchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Angle of arrival configuration			Setup 1 defined in clause A.3.15.1	
Assumption for UE beams Note 6			Rough	Rough
N_{oc} Note1	NR_TDD_FR2_A	dBm/15kHz	-112	-105
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS Note3	-103	-96
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note4	-86	-86
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
$\hat{E}_s/I_{ot}$	NR_TDD_FR2_A	dB	17	10
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
$\hat{E}_s/N_{oc}$	NR_TDD_FR2_A	dB	17	10
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-59.4	-59.4
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.2.3.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.5.5.2.3.2-1 and Table A.5.5.2.3.2-2.

Table A.5.5.2.3.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4

Table A.5.5.2.3.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4 + SMTC duration

Each interruption on E-UTRAN PCell shall not exceed 1 subframe for synchronous interband EN-DC.

Each interruption on E-UTRAN PCell shall not exceed 1 subframe.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.2.4 E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

A.5.5.2.4.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated NR SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.4.1-1.

The general test parameters are given in Table A.5.5.2.4.1-2, and NR cell specific test parameters are given in Table A.5.5.2.4.1-3 and A.5.5.2.4.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-2. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 is LTE PCell, Cell2 and Cell 3 is NR FR2 PSCell and NR FR2 deactivated SCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* for the deactivated NR SCells is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.5.5.2.4.1-1: Interruption during measurements on deactivated NR SCC supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.4.1-2: General test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is E-UTRAN RF channel and the other two are NR RF channels
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on NR RF channel number 3.
CP length		Normal	Applicable to cell1, cell 2 and cell3
AoA number		1	Applicable to cell2 and cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.5.5.2.3.1-3: NR cell specific test parameters for E-UTRAN – NR interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Frequency Range			FR2	FR2
Duplex mode	Config 1,2		TDD	TDD
TDD configuration	Config 1,2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1	
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1	
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1	
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1	
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD	-
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD	CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR.3.1 TDD	CCR.3.1 TDD
OCNG Patterns			OP.1	OP.1
SSB Configuration			SSB.1 FR2	SSB.1 FR2
SMTC Configuration	Config 1,2		SMTC.1 FR2	SMTC.1 FR2
TRS configuration	Config 1,2		TRS.2.1 TDD	TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0	TCI.State.0
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition			AWGN	AWGN
Time offset to cell1 Note 2		ms	3	3
Time offset to cell1 Note 3		µs	-	3
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells Note 3: Receive time difference of signals received between slot timing boundary from two NR Cells including time alignment error between the two cells				

Table A.5.5.2.4.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated NR SCC in asynchronous EN-DC

Parameter		Unit	Cell 2	Cell 3
Angle of arrival configuration			Setup 1 defined in clause A.3.15.1	
Assumption for UE beams Note 6			Rough	Rough
N_{oc} Note1	NR_TDD_FR2_A	dBm/15kHz	-112	-105
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS Note3	-103	-96
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note4	-86	-86
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
$\hat{E}_s/I_{ot}$		dB	17	10
$\hat{E}_s/N_{oc}$		dB	17	10
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-59.4	-59.4
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.2.4.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.5.5.2.4.2-1 and Table A.5.5.2.4.2-2.

Table A.5.5.2.4.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4

Table A.5.5.2.4.2-2: Interruption duration if the NR PSCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4 + SMTC duration

Each interruption on E-UTRAN PCell shall not exceed 1 subframe.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.2.5 E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

A.5.5.2.5.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.5.1-1.

The general test parameters are given in Table A.5.5.2.5.1-2, and NR cell specific test parameters are given in Table A.5.5.2.5.1-3 and A.5.5.2.5.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-2. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 and Cell3 is LTE PCell and LTE deactivated SCell, Cell2 is NR FR2 PSCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRA SCell is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.5.5.2.5.1-1: Interruption during measurements on deactivated E-UTRAN SCC supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.5.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in synchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and two are E-UTRAN RF channels
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to cell1, cell 2 and cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.5.5.2.5.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,c}$ = 66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SMTC Configuration	Config 1,2		SMTC.1 FR2
SSB Configuration	Config 1,2		SSB.1 FR2
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation Condition			AWGN
Time offset to cell1 Note 2		µs	3
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table A.5.5.2.5.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in synchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note1	dBm/15kHz Note4	-112
N_{oc} Note1	dBm/SCS Note3	-102.97
$\hat{E}_s/N_{oc}$	dB	17
SS-RSRP Note2	dBm/SCS Note4	-85.97
$\hat{E}_s/I_{ot}$	dB	17
Io Note2	dBm/95.04 MHz Note4	-56.90
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation		

A.5.5.2.5.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.5.5.2.5.2-1.

Table A.5.5.2.5.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	5

Table A.5.5.2.5.2-2: Void

Each interruption on E-UTRAN PCell shall not exceed 1 subframe if the PCell is not in the same band as the deactivated SCell, or 5 subframes if the PCell is in the same band as the deactivated SCell.

Each interruption on E-UTRAN PCell shall not exceed 1 subframe.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.2.6 E-UTRAN – NR FR2 interruptions during measurements on deactivated E-UTRAN SCC in asynchronous EN-DC

A.5.5.2.6.1 Test Purpose and Environment

The purpose of this test is to verify E-UTRAN PCell and NR PSCell interruptions during the measurement on the deactivated E-UTRAN SCC, the UE missed ACK/NACK does not exceed the limits. This test will verify the missed ACK/NACK rate for E-UTRAN PCell and NR PSCell in EN-DC specified in clause 8. 2.1.2. Supported test configurations are shown in table A.5.5.2.6.1-1.

The general test parameters are given in Table A.5.5.2.6.1-2, and NR cell specific test parameters are given in Table A.5.5.2.6.1-3 and A.5.5.2.6.1-4 below. And the E-UTRAN cell specific test parameters can refer to Table A.3.7.2.1-2. In the test there are three cells: Cell1 Cell2 and Cell3. Cell1 and Cell3 is LTE PCell and LTE deactivated SCell, Cell2 is NR FR2 PSCell. Cell1 shall be configured as LTE PCell and Cell2 shall be configured as NR PSCell. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated E-UTRA SCell is received by the UE, defines the start of time period T1. During T1, LTE PCell and NR PSCell are continuously scheduled in DL.

Table A.5.5.2.6.1-1: Interruption during measurements on deactivated E-UTRAN SCC supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.2.6.1-2: General test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in asynchronous EN-DC

Parameter	Unit	Value	Comment
RF Channel Number		1, 2, 3	One is NR RF channel and two are E-UTRAN RF channels
Active PCell		Cell1	PCell on E-UTRAN RF channel number 1.
Configured PSCell		Cell2	PSCell on NR RF channel number 2.
Configured deactivated SCell		Cell3	Deactivated SCell on E-UTRAN RF channel number 3.
CP length		Normal	Applicable to cell1, cell 2 and cell3
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.5.5.2.6.1-3: NR cell specific test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in asynchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode	Config 1,2		TDD
TDD configuration	Config 1,2		TDDConf.3.1
$BW_{channel}$	Config 1,2	MHz	100: $N_{RB,c}$ = 66
Downlink initial BWP Configuration	Config 1,2		DLBWP.0.1
Downlink dedicated BWP Configuration	Config 1,2		DLBWP.1.1
Uplink initial BWP configuration	Config 1,2		ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2		ULBWP.1.1
PDSCH Reference measurement channel	Config 1,2		SR.3.1 TDD
RMSI CORESET Reference Channel	Config 1,2		CR.3.1 TDD
PDCCH CORESET parameters	Config 1,2		CCR.3.1 TDD
OCNG Patterns			OP.1
SMTC Configuration	Config 1,2		SMTC.1 FR2
SSB Configuration	Config 1,2		SSB.1 FR2
TRS configuration	Config 1,2		TRS.2.1 TDD
TCI state	Config 1,2		TCI.State.0
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation Condition			AWGN
Time offset to cell1 Note 2		ms	3
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Receive time difference of signals received between subframe timing boundary of E-UTRA PCell and slot timing boundary of PSCell including time alignment error between the two cells			

Table A.5.5.2.6.1-4: NR cell specific OTA related test parameters for E-UTRAN – NR FR2 interruptions during measurements on deactivated E_UTRAN SCC in asynchronous EN-DC

Parameter	Unit	Cell2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note1	dBm/15kHz Note4	-112
N_{oc} Note1	dBm/SCS Note3	-102.97
$\hat{E}_s/N_{oc}$	dB	17
SS-RSRP Note2	dBm/SCS Note4	-85.97
$\hat{E}_s/I_{ot}$	dB	17
Io Note2	dBm/95.04 MHz Note4	-56.90
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation		

A.5.5.2.6.2 Test Requirements

The UE shall be continuously scheduled in LTE PCell and NR PSCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on NR PSCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on NR PSCell shall not exceed the value defined in Table A.5.5.2.6.2-1.

Table A.5.5.2.6.2-1: Interruption duration if the NR PSCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	5

Table A.5.5.2.6.2-2: Void

Each interruption on E-UTRAN PCell shall not exceed 1 subframe if the PCell is not in the same band as the deactivated SCell, or 5 subframes if the PCell is in the same band as the deactivated SCell.

Each interruption on E-UTRAN PCell shall not exceed 1 subframe.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.3 SCell Activation and Deactivation Delay

A.5.5.3.1 SCell Activation and deactivation of SCell in FR2 intra-band

A.5.5.3.1.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.4.5.3.1.1 except the SCell is in FR2 intra-band.

The supported test configurations are shown in table A.5.5.3.1.1-1 below. The general and cell specific test parameters are the same except those described in the following clause. The listed parameter values in Tables A.5.5.3.1.1-2 and A.5.5.3.1.1-3 will replace the values of corresponding parameters in Tables A.4.5.3.1.1-2 and A.4.5.3.1.1-3. In this case, OTA related test parameters are shown in table A.5.5.3.1.1-4 below.

Table A.5.5.3.1.1-1: Supported test configurations for FR2 SCell activation case with FR2 PSCell

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations	

Table A.5.5.3.1.1-2: General test parameters for FR2 SCell activation case with FR2 PSCell

Parameter	Unit	Value	Comment
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2

Table A.5.5.3.1.1-3: Cell specific test parameters for FR2 SCell activation case with FR2 PSCell

Parameter[Note 5]	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3

SSB ARFCN		freq1	freq2
Duplex mode		TDD	TDD
TDD configuration		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel		CR.3.1 TDD	CR.3.1 TDD
RMC CORESET Reference Channel		CCR.3.1 TDD	CCR.3.1 TDD
DL initial BWP configuration		DLBWP.0.1	
DL dedicated BWP configuration		DLBWP.1.1	
UL initial BWP configuration		ULBWP.0.1	
UL dedicated BWP configuration		ULBWP.1.1	
OCNG Patterns		OP.1	
SMTC configuration		SMTC.1	
SSB configuration		SSB.1 FR2	
TCI state		TCI.State.0	
TRS configuration		TRS.2.1 TDD	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation conditions		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: All parameters apply for configuration 1 and 2.			

Table A.5.5.3.1.1-4: OTA related test parameters for FR2 SCell activation case with FR2 PSCell

Parameter[Note 6]	Unit	Cell 2			Cell 3		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to A.3.15.1					
Assumption for UE beams[Note 7]		Rough			Rough		
N_{oc} [Note1]	dBm/15kHz[Note4]	-112			-112		
N_{oc} [Note1]	dBm/SCS[Note 3]	-102.97			-102.97		
$\hat{E}_s/N_{oc}$	dB	14			14		
SS-RSRP[Note2]	dBm/SCS [Note4]	-88.97			-88.97		
$\hat{E}_s/I_{ot}$	dB	14			14		
Io[Note2]	dBm/95.04 MHz [Note4]	-88.80			-88.80		

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: All parameters apply for configuration 1 and 2
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.3.1.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value T_{SMTC_SCell} + 5ms as defined in clause 8.3.

A.5.5.3.2 SCell Activation and deactivation of known SCell in FR1 for 160ms SCell measurement cycle

A.5.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.4.5.3.1.1, except PSCell is in FR2.

The supported test configurations are shown in table A.5.5.3.2.1-1 below. The general test parameters are the same in Tables A.4.5.3.1.1-2. The cell specific test parameters are given in Tables A.5.5.3.2.1-2. In this case, OTA related test parameters are the same as in table A.5.5.3.2.1-3.

Table A.5.5.3.2.1-1: Supported test configurations for FR1 SCell activation case with PSCell is FR2

Configuration	Description
1	FDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	FDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	FDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	TDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	TDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	TDD LTE PCell, Cell 2 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Cell 3 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations	

Table A.5.5.3.2.1-2: Cell specific test parameters for FR1 SCell activation case with FR2 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq2			freq1		
Duplex mode	Config 1,4		TDD			FDD		
	Config 2,3,5,6		TDD			TDD		
TDD configuration	Config 1,4		TDDConf.3.1			Not Applicable		
	Config 2,5					TDDConf.1.1		
	Config 3,6					TDDConf.2.1		
$BW_{channel}$	Config 1,4	MHz	100: $N_{RB,c}$ = 66			10: $N_{RB,c}$ = 52		
	Config 2,5					10: $N_{RB,c}$ = 52		
	Config 3,6					40: $N_{RB,c}$ = 106		
DL initial BWP configuration	Config 1,2,3,4,5,6		DLBWP.0.1					
DL dedicated BWP configuration	Config 1,2,3,4,5,6		DLBWP.1.1					
UL initial BWP configuration	Config 1,2,3,4,5,6		ULBWP.0.1					
UL dedicated BWP configuration	Config 1,2,3,4,5,6		ULBWP.1.1					
DRx Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.3.1 TDD			SR.1.1 FDD		
	Config 2,5					SR.1.1 TDD		
	Config 3,6					SR.2.1 TDD		
RMSI CORESET Reference Channel	Config 1,4		CR.3.1 TDD			CR.1.1 FDD		
	Config 2,5					CR.1.1 TDD		
	Config 3,6					CR.2.1 TDD		
RMC CORESET Reference Channel	Config 1,4		CCR.3.1 TDD			CCR.1.1 FDD		
	Config 2,5					CCR.1.1 TDD		
	Config 3,6					CCR.2.1 TDD		
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
TCI state			TCI.State.0			NA		
TRS configuration	Config 1,4		TRS.2.1 TDD			TRS.1.1 FDD		
	Config 2,5					TRS.1.1 TDD		
	Config 3,6					TRS.1.2 TDD		
SSB configuration	Config 1,2,4,5		SSB.1 FR2			SSB.1 FR1		
	Config 3,6					SSB.2 FR1		
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	120kHz			15kHz		
	Config 3,6					30kHz		
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
Propagation condition			AWGN			NA Link only, see clause A.3.7A		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.]

Table A.5.5.3.2.1-3: OTA related test parameters for FR1 SCell activation case with FR2 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			Setup 1 according to clause A.3.15.1			NA Link only, see clause A.3.7A		
Assumption for UE beams Note 7			Rough					
N_{oc} Note1		dBm/15kHz	-112					
N_{oc} Note1	Config 1,2,4,5	dBm/SCS	-102.97					
	Config 3,6							
SS-RSRP Note2	Config 1,2,4,5	dBm/SCS Note3	-85.97					
	Config 3,6							
$\hat{E}_s/N_{oc}$	Config 1,2,3,4,5,6	dB	17					
$\hat{E}_s/I_{ot}$		dB	17					
Io Note2	Config 1,2,4,5	dBm/ChBw Note4,Note6	-56.90					
	Config 3,6							

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: ChBW is 94.04 MHz for Cell2, 9.36 MHz for Cell 3 in configurations 1,2,4,5, 38.1 MHz in configurations 3,6
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.3.2.2 Test Requirements

The test requirements defined in clause A.4.5.3.1.2 shall apply to this test case.

A.5.5.3.3 Void

A.5.5.3.4 Void

A.5.5.3.5 SCell Activation and deactivation of SCell in FR2

A.5.5.3.5.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell is in FR2.

The supported test configurations are shown in table A.5.5.3.5.1-1 below. The test parameters are the same as in clause A.4.5.3.3.1 except those described in the following clause. The listed parameter values in Tables A.5.5.3.5.1-2 will replace the values of corresponding parameters in Tables A.4.5.3.3.1-2. The listed parameter values in Tables A.5.5.3.5.1-3 will replace the values of corresponding parameters in Tables A.4.5.3.3.1-3. In this case, OTA related test parameters are shown in table A.5.5.3.5.1-4 below.

The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are three carriers, E-UTRA has one cell (Cell 1), NR has two cells, PSCell (Cell 2) in FR1 and SCell (Cell 3) in FR2. Cell 1 and Cell 2 have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1 (PCell) on E-UTRAN and Cell 2 (PSCell) on NR, but is not aware of Cell 3 (SCell) on NR. The UE is monitoring the PCell and PSCell. The UE shall be continuously scheduled in the PCell and PSCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 3) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. Immediately at beginning of T2 the transmission power of cell 3 is increased to same level as for cell 2.

During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot $m+T_{L1\text{-}RSRP}$. In the next DL slot after slot $m+T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PSCell during activation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell1 deactivation command is sent until CSI reporting for SCell1 is discontinued.

Table A.5.5.3.5.1-1: FR2 SCell activation in non-DRX test configurations with FR1 PSCell

Configuration	Description
1	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
5	LTE TDD PCell, Cell 2 NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
6	LTE TDD PCell, Cell 2 NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Cell 3 NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.3.5.1-2: General test parameters for FR2 SCell activation case with FR1 PSCell

Parameter	Unit	Value	Comment
Active PCell		Cell 1	Primary cell on E-UTRAN RF channel number 1. As specified in clause A.3.7.2.2
T2	s	2	During this time the UE shall activate the SCell.

Table A.5.5.3.5.1-3: Cell specific test parameters for FR2 SCell activation case with FR1 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
SSB ARFCN			freq1			freq2		
Duplex mode	Config 1,4		FDD			TDD		
	Config 2,3,5,6		TDD			TDD		
TDD configuration	Config 1,4		Not Applicable			TDDConf.3.1		
	Config 2,5		TDDConf.1.1					
	Config 3,6		TDDConf.2.1					
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52			100: $N_{RB,c}$ = 66		
	Config 2,5		10: $N_{RB,c}$ = 52					
	Config 3,6		40: $N_{RB,c}$ = 106					
BWP BW	Config 1,4		10: $N_{RB,c}$ = 52			100: $N_{RB,c}$ = 66		
	Config 2,5		10: $N_{RB,c}$ = 52					
	Config 3,6		40: $N_{RB,c}$ = 106					
DRx Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD			SR.3.1 TDD		
	Config 2,5		SR.1.1 TDD					
	Config 3,6		SR.2.1 TDD					
CSI-RS configuration	Config 1~6		NA			NA	CSI-RS.3.1 TDD Note 5	
CSI reporting periodicity Note 6	Config 1~6	ms	NA			5		
RMSI CORESET Reference Channel	Config 1,4		CR.1.1 FDD			CR.3.1 TDD		
	Config 2,5		CR.1.1 TDD					
	Config 3,6		CR.2.1 TDD					
RMC CORESET Reference Channel	Config 1,4		CCR.1.1 FDD			CCR.3.1 TDD		
	Config 2,5		CCR.1.1 TDD					
	Config 3,6		CCR.2.1 TDD					
OCNG Patterns			OP.1					
SMTC configuration			SMTC.1					
TCI state			NA			TCI.State.0		
TRS configuration	Config 1,4		TRS.2.1 TDD			TRS.2.1 TDD		
	Config 2,5		TRS.1.1 TDD					
	Config 3,6		TRS.1.2 TDD					
SSB configuration	Config 1,2,4,5		SSB.1 FR1			SSB.1 FR2		
	Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz			120 kHz		
	Config 3,6		30 kHz					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
Propagation condition			N/A Link only, see clause A.3.7A			AWGN		

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.
Note 5:	CSI-RS for CSI measurement is (re)configured in the next DL slot after slot m+$T_{L1\text{-}RSRP}$ during T2.
Note 6:	L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.5.5.3.5.1-4: OTA related test parameters for FR2 SCell activation case with FR1 PSCell

Parameter		Unit	Cell 2			Cell 3		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			NA Link only, see clause A.3.7A			Setup 1 according to clause A.3.15.1		
Assumption for UE beams Note 7						Rough		
N_{oc} Note1		dBm/15kHz				-112		
N_{oc} Note1	Config 1,2,4,5	dBm/SCS				-102.97		
	Config 3,6							
SS-RSRP Note2	Config 1,2,4,5	dBm/SCS Note3				-85.97		
	Config 3,6							
$\hat{E}_s/N_{oc}$	Config 1,2,3,4,5,6	dB				17		
$\hat{E}_s/I_{ot}$		dB				17		
Io Note2	Config 1,2,4,5	dBm/ChBw Note4,Note6				-56.90		
	Config 3,6							

Note 1:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3:	SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4:	Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5:	As observed with 0 dBi gain antenna at the centre of the quiet zone
Note 6:	ChBW is 94.04 MHz for Cell2, 9.36 MHz for Cell 3 in configurations 1,2,4,5, 38.1 MHz in configurations 3,6
Note 7:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.3.5.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PSCell in the slot.

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot (m+$T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than

$$3\text{ms} + T_{FirstSSB\_MAX} + 15*T_{SMTC\_MAX} + 8*T_{rs} + T_{L1\text{-}RSRP,\ measure} + T_{L1\text{-}RSRP,\ report}$$

as defined in clause 8.3.2. For this test case, $T_{FirstSSB\_MAX}$=T_{SMTC_MAX}=T_{rs}=20ms; $T_{L1\text{-}RSRP,\ measure}$=480ms and $T_{L1\text{-}RSRP,\ measure}$=5ms, which allows $T_{L1\text{-}RSRP}$ 1000ms.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot $\mathrm{m} + \frac{\mathrm{T_{HARQ}} + T_{\mathrm{activtion\_time}} + T_{\mathrm{CSI\_Reporting}}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in Table A.5.5.3.1.1-2

- $T_{activation\_time}$ = 3ms + $T_{FirstSSB\_MAX}$ + 15*T_{SMTC_MAX} + 8*T_{rs} + $T_{L1\text{-}RSRP, measure}$ + $T_{L1\text{-}RSRP, report}$ + max {(T_{HARQ} + $T_{uncertainty\_MAC}$ + 5ms + $T_{FineTiming}$), ($T_{uncertainty\_RRC}$ + T_{RRC_delay})}, which allows 1030ms

- $T_{CSI\_Reporting}$ = 10ms

- NR slot length is 0.125ms for this test case.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot $\mathrm{n} + \frac{\mathrm{T_{HARQ}+3ms}}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PSCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $m + 1 + \frac{T_{\mathrm{HARQ}} + 3\mathrm{ms} + T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}}$, and interruption of E-UTRA PCell during SCell activation shall not happen outside the subframe $m_1 + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{EUTRA\ slot\ length}}$ to subframe $m_2 + 1 + \frac{T_{\mathrm{HARQ}} + 3\mathrm{ms} + T_{\mathrm{X}}}{\mathrm{EUTRA\ slot\ length}}$, as defined in clause 8.3, where T_X =20ms, and m_1 and m_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot m.

During T3 the starting point of interruption of PSCell during SCell deactivation shall not happen outside the slot $\mathrm{n} + 1 + \frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to $\mathrm{n} + 1 + \frac{\mathrm{T_{HARQ}+3ms}}{NR\ slot\ length}$, as defined in clause 8.3 and the starting point of interruption of E-UTRA PCell during SCell deactivation shall not happen outside the subframe $n_1 + 1 + \frac{T_{\mathrm{HARQ}}}{EUTRA\ subframe\ length}$ to subframe $\mathrm{n}_2 + 1 + \frac{T_{\mathrm{HARQ}} + 3\mathrm{ms}}{EUTRA\ subframe\ length}$, where n_1 and n_2 are the index of the first and last subframe of E-UTRA PCell which overlaps with slot n.

The interruption of PSCell due to activation of SCell1 and SCell2 shall not be more than the values specified for EN-DC in Clause 8.2.1.2.10.

The interruption of PCell due to activation of SCell1 and SCell2 shall not be more than the values specified for EN-DC in Clause 7.32.2.5 of TS 36.133 [50].

A.5.5.4 Void

A.5.5.5 Beam Failure Detection and Link recovery procedures

A.5.5.5.1 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with SSB-based BFD and LR in non-DRX mode

A.5.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.5.5.5.1.1-1, A.5.5.5.1.1-2, A.5.5.5.1.1-3 and A.5.5.5.1.1-4 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.1.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.5.5.5.1.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 1.

Table A.5.5.5.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	LTE TDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.5.1.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1, 2		TDD	
$BW_{channel}$	Config 1, 2		100: $N_{RB,c}$ = 66	
DL initial BWP configuration	Config 1, 2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1	
TDD Configuration	Config 1, 2		TDDConf.3.1	
CORESET Reference Channel	Config 1, 2		CR.3.1 TDD	
SSB Configuration	Config 1, 2		SSB.1 FR2	
SMTC Configuration	Config 1, 2		SMTC.3	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.3.4	
SSB index assigned as BFD RS (q_0)			0	
SSB index assigned as CBD RS (q_1)			1	
TCI Configuration	Config 1, 2		TCI.State.0	
OCNG parameters			OP.1	
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB		dBm/SCS kHz	-94.5	Threshold used for $Q_{in\_LR\_SSB}$

powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD	
TCI states			TCI.State.0	
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD	
SSB index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	2.61	
T3		s	1.64	
T4		S	0	
T5		s	1.01	
D1		s	0.97	
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.5.5.5.1.1-3: Cell specific test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	0.2	0.2	20.2	20.2	20.2
	Config 2		0.2	0.2	20.2	20.2	20.2
SNR_SSB of set q_1	Config 1	dB	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-104.5	-104.5	-84.5	-84.5	-84.5
SSB_RP of set q_1	Config 1	dBm/ SCS kHz	0.2	0.2	20.2	20.2	20.2
	Config 2		0.2	0.2	20.2	20.2	20.2
N_{oc}	Config 1	dBm/120 KHz	-104.7				
	Config 2		-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.5.5.1.1-4: Void

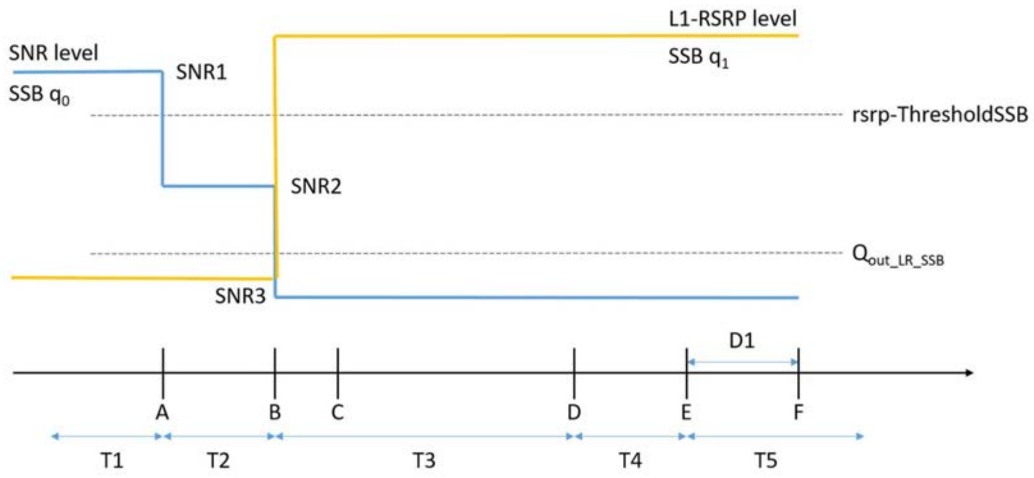


Figure A.5.5.5.1.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.5.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 960+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.5.2 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with SSB-based BFD and LR in DRX mode

A.5.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.5.5.5.2.1-1, A.5.5.5.2.1-2, A.5.5.5.2.1-3, A.5.5.5.2.1-4 and A.5.5.5.2.1-5 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.2.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate

SSB based beam failure. Figure A.5.5.5.2.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PCSell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.5.5.5.2.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	LTE TDD, TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.5.5.5.2.1-2: General test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1, 2		TDD	
$BW_{channel}$	Config 1, 2		100: $N_{RB,c}$ = 66	
DL initial BWP configuration	Config 1, 2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1	
TDD Configuration	Config 1, 2		TDDConf.3.1	
CORESET Reference Channel	Config 1		CR. 3.1 TDD	
SSB Configuration	Config 1		SSB.1 FR2	
	Config 2		SSB.2 FR2	
SMTC Configuration	Config 1, 2		SMTC.3	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.3.4	
SSB index assigned as BFD RS (q_0)			0	
SSB index assigned as CBD RS (q_1)			1	
TCI Configuration	Config 1, 2		TBD	
OCNG parameters			OP.1	
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.3	A.3.3.3
Gap pattern ID			N.A.	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB		dBm/SCS kHz	TBD	Threshold used for $Q_{in\_LR\_SSB}$
rsrp-ThresholdSSB	Config 1	dBm/SSB SCS	-94.5	Threshold used for $Q_{in\_LR\_SSB}$
	Config 2		-91.5	

powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD	A.3.14.2
TCI states			TCI.State.0	
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD	
SSB index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	3.37	
T3		s	2.8	
T4		s	0	
T5		s	0.61	
D1		s	0.57	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.5.5.5.2.1-3: Cell specific test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
	Config 2		0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1	dBm/SSB SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1	dBm/120 KHz	-104.7				
	Config 2		-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.2.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.5.5.2.1-4: Void

Table A.5.5.5.2.1-5: Void

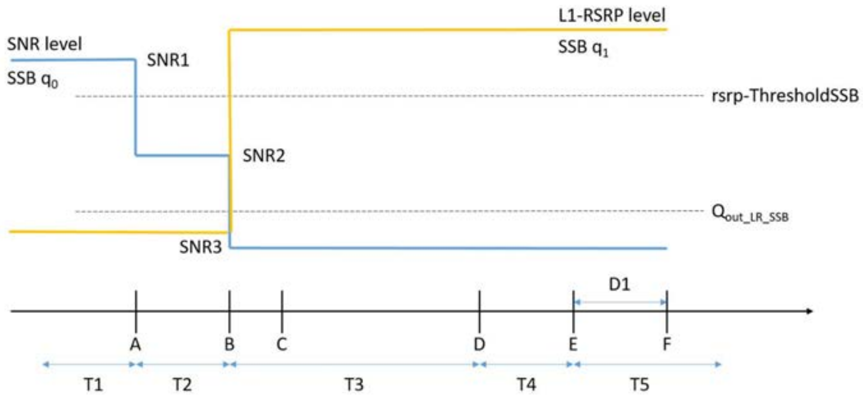


Figure A.5.5.5.2.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.5.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 560+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.5.3 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.5.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.5.5.5.3.1-1, A.5.5.5.3.1-2, and A.5.5.5.3.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.3.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the CSI-RS in set q_0 in the active PSCell to emulate CSI-RS based beam failure. Figure A.5.5.5.3.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is not enabled.

Table A.5.5.5.3.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.5.5.5.3.1-2: General test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
CORESET Reference Channel	Config 1		CR.3.1 TDD	A.3.1.2
SSB Configuration	Config 1		SSB.3 FR2	A.3.10
SMTC Configuration	Config 1		SMTC.3	A.3.11
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz	
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
TRS configuration			TRS.2.1 TDD	
TCI configuration			CSI-RS.Config.0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB		dBm/SCS kHz	-94.5	Threshold used for $Q_{in\_LR\_SSB}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17

CSI-RS configuration for q_0 and q_1	Config 1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.3.1 TDD	A.3.14.2
csi-RS-Index assigned as RLM RS	Config 1		CSI-RS.3.2 TDD	A.3.14.2
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	1.17	
T3		s	0.9	
T4		s	0	
T5		s	0.31	
D1		s	0.27	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.5.5.5.3.1-3: Cell specific test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/15 KHz	-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.3.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.5.5.3.1-4: Void

Table A.5.5.5.3.1-5: Void

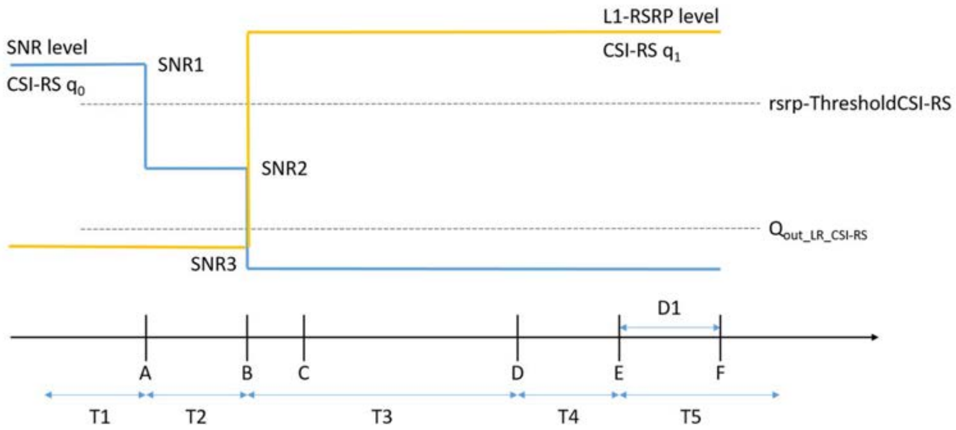


Figure A.5.5.5.3.1-1: SNR and L1-RSRP variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

A.5.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.5.4 EN-DC Beam Failure Detection and Link Recovery Test for FR2 PSCell configured with CSI-RS-based BFD and LR in DRX mode

A.5.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving PSCell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP of the PSCell, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.5.5.5.4.1-1, A.5.5.5.4.1-2, A.5.5.5.4.1-3, and A.5.5.5.4.1-4 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.4.1-1 shows the variation of the downlink SNR of the PCell and the SNR of the CSI-RS in set q_0 in the active PSCell to emulate CSI-RS based beam failure. Figure A.5.5.5.4.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.5.5.5.4.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.5.5.5.4.1-2: General test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
CORESET Reference Channel	Config 1		CR.3.1 TDD	A.3.1.2
SSB Configuration	Config 1		SSB.3 FR2	A.3.10
SMTC Configuration	Config 1		SMTC.3	A.3.11
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz	
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
TRS configuration			TRS.2.1 TDD	
TCI configuration			CSI-RS.Config.0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.3	A.3.3.3
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB		dBm/SCS kHz	-94.5	Threshold used for $Q_{in\_LR\_SSB}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS

beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS configuration for q_0 and q_1	Config 1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.3.1 TDD	A.3.14.2
csi-RS-Index assigned as RLM RS	Config 1		CSI-RS.3.2 TDD	A.3.14.2
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	5.43	
T3		s	5.16	
T4		s	0	
T5		s	0.31	
D1		s	0.27	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.5.5.5.4.1-3: Cell specific test parameters for FR2 PSCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.155				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/15 KHz	-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.4.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.5.5.4.1-4: Void

Table A.5.5.5.4.1-5: Void

Table A.5.5.5.4.1-6: Void

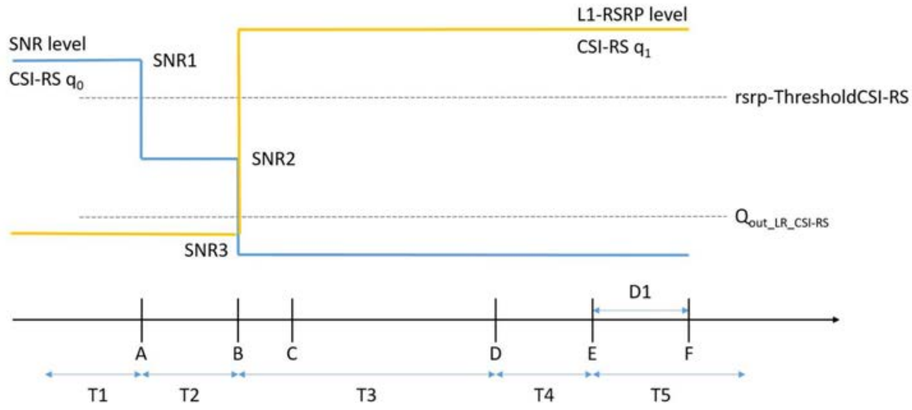


Figure A.5.5.5.4.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.5.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.5.5 EN-DC scheduling availability restriction during Beam Failure Detection and Link Recovery for FR2 PSCell configured with SSB-based BFD and LR in non-DRX mode

A.5.5.5.5.1 Test Purpose and Environment

The purpose is to test scheduling availability restrictions when the UE is performing beam failure detection or when the UE is performing L1-RSRP measurement for candidate beam detection, when no DRX is used. This test will verify the scheduling availability restriction requirements for SSB based beam failure detection and link recovery for an FR2 serving cell in clause 8.5.7 and 8.5.8.

The test parameters are given in Tables A.5.5.5.5.1-1, A.5.5.5.5.1-2 and A.5.5.5.5.1-3 below. There are two cells, cell 1 is the E-UTRAN PCell, and cell 2 is the PSCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.5.5.5.5.1-3 shows the variation of the downlink

SNR of the PCell and the SNR of the SSB in set q_0 in the active PSCell to emulate SSB based beam failure. Figure A.5.5.5.5.1-3 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1 and cell 2. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. This test will focus on the scheduling availability during beam failure detection and candidate beam detection. In the test, DRX configuration is not enabled. Test is to test the scheduling availability restriction of UE performing beam failure detection and candidate beam detection when SSB RS configured for Beam failure detection and candidate beam detection. During the test the UE is scheduled to transmit continuously in UL.

Table A.5.5.5.5.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.5.5.1-2: General test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active E-UTRA PCell			Cell 1	
E-UTRA RF Channel Number			1	
Active PSCell			Cell 2	
RF Channel Number			2	
Duplex mode	Config 1,2		TDD	
TDD Configuration	Config 1,2		TDDConf.3.1	
DL initial BWP configuration	Config 1, 2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1	
CORESET Reference Channel	Config 1,2		CR.3.1 TDD	
SSB Configuration	Config 1,2		SSB.1 FR2	
SMTC Configuration	Config 1,2		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1,2		120 KHz	
SSB index assigned as BFD RS (q_0)			0	
SSB index assigned as CBD RS (q_1)			1	
TRS configuration			TRS.2.1 TDD	
TCI configuration			TCI.State.0	
OCNG parameters			OP.1	
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	DRX is not in use
Gap pattern ID			N.A.	No measurement gap pattern is configured
ssb-Index			2	Number of SSB indexes used for beam failure detection
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB		dBm/SCS kHz	-94.5	Threshold used for $Q_{in\_LR\_SSB}$

powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17
beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI-RS Configuration for reporting	Config 1, 2		CSI-RS.3.1 TDD	A.3.14.2
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the UE shall be fully synchronized to cell 1
T2		s	2.6	
T3		s	1.64	
T4		s	0	
T5		s	1.01	
D1		s	0.97	
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.5.5.5.5.1-3: Cell specific test parameters for FR2 PSCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams[Note 10]			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
	Config 2		0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1	dBm/ SCS kHz	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/15KHz	-104.7				
	Config 2		-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.5.5.5.5.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

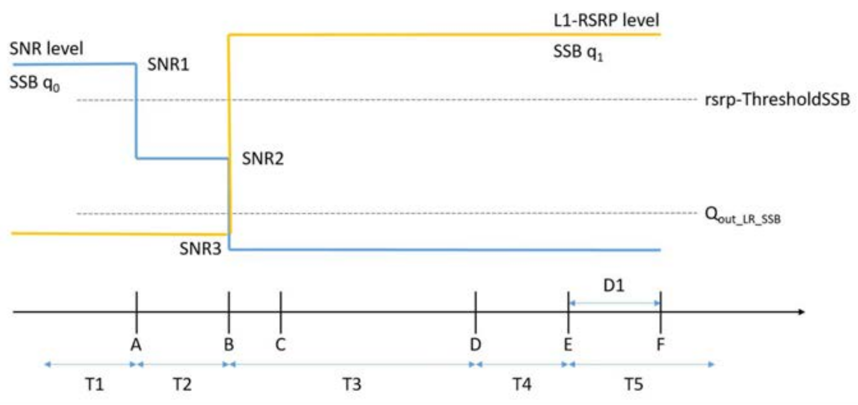


Figure A.5.5.5.5.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.5.5.5.5.2 Test Requirements

The UE behaviour during time duration T3 follows the requirements defined in clause 8.5.7.3:

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on BFD-RS symbols to be measured for beam failure detection.

The UE behaviour during time durations T4 and T5 follows the requirements defined in clause 8.5.8.3:

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on reference symbols to be measured for candidate beam detection.

A.5.5.6 Active BWP switch

A.5.5.6.1 DCI-based and Timer-based Active BWP Switch

A.5.5.6.1.1 E-UTRAN – NR PSCell FR2 DL active BWP switch with non-DRX in synchronous EN-DC

A.5.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in TS38.133 clause 8.6, and interruption requirement for E-UTRA victim cell defined in TS36.133 clause 7.32.2.7. Supported test configurations are shown in Table A.5.5.6.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in Table A.5.5.6.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in Table A.5.5.6.1.1.1-3 below. The OTA related test parameters for FR2 is shown in Table A.5.5.6.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

> Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE should switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the beginning slot of the DL subframe immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell at latest at the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}$).

The starting time of PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell during BWP switch of PSCell, respectively.

Table A.5.5.6.1.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: A UE which fulfils the requirements in test case A.5.5.2.2 can skip the test cases in A.5.5.2.1.	

Table A.5.5.6.1.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
bwp-InactivityTimer	ms	[200]	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	μs	3	Synchronous EN-DC
T1	s	[0.2]	
T2	s	[0.2]	
T3	s	[0.2]	

Table A.5.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{RB,c}$ = 66
Active BWP ID		1, 2
Initial DL BWP Configuration		DLBWP.0.2 Note 2
Active DL BWP-1 Configuration		DLBWP.1.1 Note 2
Active DL BWP-2 Configuration		DLBWP.1.3 Note 2
Initial UL BWP Configuration		ULBWP.0.2 Note 2
Active UL BWP-1 Configuration		ULBWP.1.1 Note 2
Active UL BWP-2 Configuration		ULBWP.1.3 Note 2
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State		TCI.State.0
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

Table A.5.5.6.1.1.1-4: OTA related test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note 1	dBm/15 kHz	-112
N_{oc} Note 1	dBm/SCS	-103
SS-RSRP Note 2	dBm/120 kHz Note3	-85
$\hat{E}_s/I_{ot}$	dB	18
Io Note2	dBm/95.04 MHz Note4	-56

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone.
Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in the DL slot right after DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in the DL slot right after DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start time of PCell interruption during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start time of PCell interruption during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS36.133 Clause 7.32.2.7.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after DL slot ($i+Y1$), ($j+Y2$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

Editor's note: whether E-UTRA PCell's interruption test requirement is needed or not depends on whether E-UTRA Pcell's interruption could be tested when PSCell is FR2 cell.

A.5.5.6.1.2 E-UTRAN – NR PSCell FR2 DL active BWP switch with FR2 SCell in non-DRX in synchronous EN-DC

A.5.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6.2, and interruption requirements for NR victim cell defined in clause 8.2.1.2.7 and interruption requirement for E-UTRA victim cell defined in TS36.133 clause 7.32.2.7. Supported test configurations are shown in Table A.5.5.6.1.2.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), one NR PSCell (Cell 2) and one NR SCell (Cell 3) as given in Table A.5.5.6.1.2.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell and SCell are specified in Table A.5.5.6.1.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) and SCell (Cell 3) to ensure that the UE will have ACK/NACK sending.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 2 and the time duration of T2.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), Cell 2 (PSCell) on radio channel 2 (PSCC) and Cell 3 (SCell) on radio channel 3 (SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PSCell, BWP-1 and BWP-2, in Cell 2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for SCell, BWP-0 in Cell 3 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PSCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in SCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PSCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PSCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-2 starting from the beginning of the DL slot right after slot ($i+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch on PSCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PSCell(Cell 2).

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after the slot wherein *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PSCell at latest at the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($j+T_{BWPswitchDelay}$).

PCell(Cell 1) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

SCell(Cell 3) interruption due to BWP switch of PSCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PSCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

The test equipment verifies that potential interruption to E-UTRA PCell and NR SCell is carried out in the correct time span by monitoring ACK/NACK sent in PCell and SCell during BWP switch of PSCell, respectively.

Table A.5.5.6.1.2.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: A UE which fulfils the requirements in test case A.5.5.6.1.2 can skip the test cases in A.5.5.6.1.1. Note 3: NR configuration is the same for PSCell and SCells.	

Table A.5.5.6.1.2.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2, 3	Two NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
Active SCell		Cell 3	SCell on RF channel number 3.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	[200]	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell-individual offset for cells on RF channel number 3	dB	0	Individual offset for cells on SCC.
Cell2 timing offset to cell1	µs	3	Synchronous EN-DC
Cell3 timing offset to cell2	µs	3	Synchronous cells
T1	s	[0.2]	
T2	s	[0.2]	
T3	s	[0.2]	

Table A.5.5.6.1.2.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2	Cell 3
Frequency Range		FR2	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$		100 MHz: $N_{RB,c}$ = 66	
Active BWP ID		1, 2	0
Initial DL BWP Configuration		DLBWP.0.2	DLBWP.0.2
Active DL BWP-0 Configuration		NA	DLBWP.0.2
Active DL BWP-1 Configuration		DLBWP.1.3	NA
Active DL BWP-2 Configuration		DLBWP.1.1	NA
Initial UL BWP Configuration		ULBWP.0.2	ULBWP.0.2
Active UL BWP-0 Configuration		NA	ULBWP.0.2
Active UL BWP-1 Configuration		ULBWP.1.3	NA
Active UL BWP-2 Configuration		ULBWP.1.1	NA
PDSCH Reference measurement channel		SR.3.1 TDD	
RMSI CORESET parameters		CR.3.1 TDD	
Dedicated CORESET parameters		CCR.3.1 TDD	
OCNG Patterns		OP.1	
SSB Configuration		SSB.1 FR2	
SMTC Configuration		SMTC.1	
TCI State		TRS.2.1 TDD	
TRS Configuration		TCI.State.0	
Antenna Configuration		1x2	
Propagation Condition		AWGN	
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3.

Table A.5.5.6.1.2.1-4: OTA related test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15	
N_{oc} Note 1	dBm/15 kHz	-112	-112
SS-RSRP Note 2	dBm/120 kHz Note3	-85	-85
$\hat{E}_s/I_{ot}$	dB	18	18
Io Note2	dBm/95.04 MHz Note4	-56	-56
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone.			

A.5.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK for PSCell in the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK for PSCell in the DL slot right after slot ($j+T_{BWPswitchDelay}+k1$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of PCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of PCell shall not be longer than the interruption duration specified for active BWP switch in TS36.133 Clause 7.32.2.7.

During T1, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

During T3, the start of the interruption of SCell during PSCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in Clause 8.6.2.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the DL slot right after slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

Editor's note: FFS value of k1 for type 1 and type 2 UE.

A.5.5.6.2 RRC-based Active BWP Switch

A.5.5.6.2.1 E-UTRAN – NR PSCell FR2 DL active BWP switch with non-DRX in synchronous EN-DC

A.5.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.3. Supported test configurations are shown in Table A.5.5.6.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1) and one NR PSCell (Cell 2) as given in Table A.5.5.6.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell are specified in Table A.5.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC) and to Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 2 (PSCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PSCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to completely receive PDSCH at the beginning of the DL slot right after PSCell's DL slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$) as defined in clause 8.6.3 and be ready for the reception of uplink grant for the PSCell no later than at the beginning of the DL slot right after slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$). The UE shall be continuously scheduled on PSCell's BWP-1 starting from the beginning of the DL slot right after slot ($i+T_{RRCprocessingDelay}+T_{BWPswitchDelayRRC}$).

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated BWP configurationis sent till the time when RRC Reconfiguration Complete message is received.

Table A.5.5.6.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.6.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	μs	3	Synchronous EN-DC
T1	s	[0.2]	

Table A.5.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 2
Frequency Range			FR2
Duplex mode			TDD
TDD configuration			TDDConf.3.1
$BW_{channel}$			100 MHz: $N_{RB,c}$ = 66
Active BWP ID			1
Initial DL BWP Configuration			DLBWP.0.2
Initial UL BWP Configuration			ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration		DLBWP.1.3
	Active UL BWP-1 Configuration		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration		DLBWP.1.1
	Active UL BWP-1 Configuration		ULBWP.1.1
PDSCH Reference measurement channel			SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD
Dedicated CORESET parameters			CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration			SMTC.1
TCI State			TCI.State.0
TRS Configuration			TRS.2.1 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

Table A.5.5.6.2.1.1-4: OTA related test parameters for BWP switching test case

Parameter		Unit	Cell 2
Angle of arrival configuration			Setup 1 according to table A.3.15
Assumption for UE beams Note 5			Fine
N_{oc} Note1	NR_TDD_FR2_A	dBm/15kHz	-112
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS	-103
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note3	-85
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/I_{ot}$		dB	18
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-56
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

A.5.5.6.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PSCell in the beginning of the DL slot right after slot (i+$T_{RRCprocessingDelay}$+$T_{BWPswitchDelayRRC}$).

All of the above test requirements shall be fulfilled in order for the observed PSCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

A.5.5.7 PSCell addition and release delay

A.5.5.7.1 Addition and Release Delay of NR PSCell

A.5.5.7.1.1 Test purpose and environment

The purpose of this test is to verify that the NR PSCell addition and release delays under EN-DC are within the requirements stated in clause 7.31.2 of TS 36.133 [15] for the case when the PSCell is unknown by the UE at the time of addition.

Supported test configurations are shown in A.5.5.7.1.1-1. The test parameters for the E-UTRA cell are given in Table A.3.7.2.1-1. The E-UTRA cell once set up is not changed across time.

The test parameters for NR cell are given in Tables A.5.5.7.1.1-2, cell-specific parameters in A.5.5.7.1.1-3 and OTA parameters in A.5.5.7.1.1-4 below. The test consists of four successive time periods with duration of T1, T2, T3 and T4. There are two carriers each with one cell. Before the test starts the UE is connected to Cell 1 (E-UTRA PCell) on radio channel 1 (PCC) but is not aware of Cell 2 (NR PSCell) on radio channel 2. The UE is only monitoring the PCC. During T1 only Cell1 is known to the UE.

The test system shall send a RRC message to the UE to add PSCell (Cell 2) on radio channel 2. The RRC message (to add PSCell) also includes a request for the UE to start periodic CSI reporting for the PSCell after the PSCell has been successfully added. The RRC message to add PSCell shall be sent to the UE during period T1. The point in time at which the RRC message to add PSCell (Cell2) is received at the UE antenna connector defines the start of period T2.

The test system shall observe the periodic reporting of CSI for PSCell during T3. The point in time at which the UE has sent PRACH to the PSCell (Cell 2) defines the start of period T3.

The test system shall send a RRC message to the UE to release PSCell (Cell 2) on radio channel 2. The RRC message to release PSCell (Cell2) shall be sent to the UE during period T3, after the UE has sent at least one CQI report with non-zero CQI index for PSCell (Cell 2). The point in time at which the RRC message to release PSCell (Cell2) is received at the UE antenna connector defines the start of period T4.

Table A.5.5.7.1.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	LTE FDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
2	LTE TDD, NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.7.1.1-2: General Test Parameters for PSCell Addition and Release

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test. One for E-UTRA cell and second for NR Cell
Initial Condition	Active PCell		Cell1	PCell on RF channel number 1.
	Neighbour cell		Cell2	Neighbour cell on RF channel number 2.
Final Condition	Active PCell		Cell1	PCell on RF channel number 1.
	Neighbour Cell		Cell2	PSCell released on RF channel number 2.
B1	Hysteresis	dB	0	Hysteresis for evaluation of event B1.
	Threshold RSRP	dBm	--100	Actual RSRP threshold for event B1. Needs to take absolute accuracy tolerance in clause 9.1.11.1 into account plus margin.
	Time to Trigger	s	0	
DRX			OFF	Continuous monitoring of primary cell
PRACH configuration on cell2			FR2 configuration 2	Captured in A.3.8.3.2
CQI/PMI periodicity and offset configuration index on cell2			TBD	CQI reporting for PSCell every uplink subframe
Cell-individual offset for cells on RF channel number 1		dB	0	Individual offset for cells on primary component carrier.
Cell-individual offset for cells on RF channel number 2		dB	0	Individual offset for cells on carrier frequency of cell2.
T1		s	1	During this time the PCell shall be known and cell2 shall be unknown.
T2		s	1	During this time the UE adds the PSCell.
T3		s	1	During this time the UE sends CSI reports for PSCell.
T4		s	1	During this time the UE releases the PSCell.

Table A.5.5.7.1.1-3: Cell Specific Parameters for PSCell Addition and Release

Parameter	Unit	Config	Test			
			T1	T2	T3	T4
E-UTRA Channel Number		1,2	1			
NR Channel Number		1,2	2			
Duplex Mode		1,2	TDD			
TDD configuration		1,2	TDDConf.1.2			
$BW_{channel}$	MHz	1,2	100: NRB,c = 66			
Initial BWP Configuration		1,2	DLBWP.0.1 ULBWP.0.1			
Dedicated BWP Configuration		1,2	DLBWP.1.1 ULBWP.1.1			
TRS Configuration		1	TRS.2.1 TDD			
TCI State		1	CSI-RS.Config.0			
PDSCH Reference measurement channel		1,2	SR.3.1 TDD			
RMSI CORESET Reference Channel		1,2	CR.3.1 TDD			
Dedicated CORESET Reference Channel		1,2	CCR.3.1 TDD			
OCNG Patterns		1,2	OP.1			
SSB configuration		1,2	SSB.1 FR2			
SMTC configuration		1,2	SMTC.2			
TRS Configuration		1,2	TRS.2.1 TDD			
EPRE ratio of PSS to SSS	dB	1,2	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
Propagation condition		1,2	AWGN			

Table A.5.5.7.1.1-4: OTA related test parameters

Parameter	Unit	Test
Angle of arrival configuration		Setup 2a according to clause A.3.15.2.1
Assumption for UE beams Note 6		Rough
N_{oc} Note1	dBm/15kHz Note4	TBD
N_{oc} Note1	dBm/SCS Note3	TBD
$\hat{E}_s/N_{oc}$	dB	TBD
SS-RSRP Note2	dBm/SCS Note4	TBD
$\hat{E}_s/I_{ot}$	dB	TBD
Io Note2	dBm/95.04 MHz Note4	TBD
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation		

A.5.5.7.1.2 Test Requirements

The UE shall transmit the PRACH to PSCell at latest 582 ms Note1 into T2.

The UE shall send at least one CSI report for PSCell with non-zero CQI index during T4.

The UE shall periodically send CSI reports for PSCell after the UE has sent first CQI report with non-zero CQI index during T4

The UE shall stop sending CSI reports for PSCell in at latest 20 ms into T5.

All the above test requirements shall be fulfilled for the observed PSCell addition delay and PSCell release delay to be counted as correct. The rate of correct observed PSCell addition delay and PSCell release delay during repeated tests shall be at least 90%.

Note1: The PSCell addition delay can be expressed as follows as specified in clause 7.31.2 of TS 36.133 [15]:

$$T_{config\_PSCell} = T_{RRC\_delay} + T_{processing} + T_{search} + T_{\Delta} + T_{PSCell\_DU} + 2ms$$

Where:

T_{RRC_delay} = 20ms

$T_{processing}$ = 40ms

T_{search} = 8*3*20 = 480 ms

T_{Δ} = 20ms

T_{PSCell_DU} = 1*10+10 = 20 ms

A.5.5.8 Active TCI state switch delay

A.5.5.8.1 MAC-CE based active TCI state switch

A.5.5.8.1.1 E-UTRAN – NR PSCell FR2 active TCI state switch for a known TCI state

A.5.5.8.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3Supported test configurations are shown in Table A.5.5.8.1.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in Table A.5.5.8.1.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in Table A.5.5.8.1.1.1-3 below. The OTA related test parameters for FR2 is shown in Table A.5.5.8.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 2 different TCI states for PSCell, PDCCH TCI state 0 (QCL'd to SSB0) and TCIstate 1 (QCL'd to SSB1), in Cell 2 before starting the test.
- UE is indicated in TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. During T1 only SSB to which PDCCH-TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PSCell on TCI state 0 till n+ T_{HARQ} +3 ms.The test equipment also verifies the TCI state switch time in PSCell by scheduling the UE on TCI state 1 after n+ T_{HARQ} +3 ms + ($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$) .

Table A.5.5.8.1.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.8.1.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	µs	3	Synchronous EN-DC
T1	s	0.2	
T2	s	0.2	

Table A.5.5.8.1.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{RB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI.State.0
TCI State 1		TCI.State.1
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.5.5.8.1.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 2			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough		Rough	
N_{oc} Note 1	dBm/15 kHz	-92.1			
N_{oc} Note 1	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1	1	1	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1	-82.1	-82.1	-82.1
Io Note2,Note6	dBm/95.04 MHz Note4	-54.94	-54.94	-54.94	-54.94

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.
Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.5.8.1.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on TCI state 0 till n+ T_{HARQ} +3 ms
- be able to start receiving on TCI state 1 after n+ T_{HARQ} +5 ms + $T_{first\text{-}SSB}$

A.5.5.8.2 RRC based active TCI state switch

A.5.5.8.2.1 E-UTRAN – NR PSCell FR2 active TCI state switch for a known TCI state

A.5.5.8.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3Supported test configurations are shown in Table A.5.5.8.2.1.1-1.

The test scenario comprises of one E-UTRA PCell (Cell 1), and one NR PSCell (Cell 2) as given in Table A.5.5.8.2.1.1-2. Cell-specific parameters of E-UTRA PCell are specified in Table A.3.7.2.1-1 and Cell-specific parameters of NR PSCell is specified in Table A.5.5.8.2.1.1-3 below. The OTA related test parameters for FR2 is shown in Table A.5.5.8.2.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PSCell (Cell 2) to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (PSCell) on radio channel 2 (PSCC).
- UE is configured with 1 TCI state for PSCell, PDCCH-TCI-state0 (QCL'd to SSB0)

- UE is indicated in TCI state0 as the active TCI state

The test consists of two time periods, T1 and T2. During T1 only SSB to which TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI-state1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a RRC command indicating a switch to TCI-state1.

The test equipment verifies the TCI state switch time in PSCell by scheduling the UE on TCI state 1 after n+ $T_{RRC\_processing}$ + $T_{first\text{-}SSB}$ + 2ms.

Table A.5.5.8.2.1.1-1: Supported test configurations

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.5.5.8.2.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
E-UTRA RF Channel Number		1	One E-UTRA radio channel is used for this test
NR RF Channel Number		2	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active PSCell		Cell 2	PSCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	µs	3	Synchronous EN-DC
T1	s	0.2	
T2	s	0.2	

Table A.5.5.8.2.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 2
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{RB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TC. State.0
TCI State 1		TCI.State.1
TRS Configuration		TRS.2.1 TDD
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
Number of reported RS		2
L1-RSRP reporting period	slot	640
timeRestrictionForChannelMeasurements		configured
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.5.5.8.2.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 2			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough		Rough	
N_{oc} Note 1	dBm/15 kHz	-92.1			
N_{oc} Note 1	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1	1	1	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1	-82.1	-82.1	-82.1
Io Note2,Note6	dBm/95.04 MHz Note4	-54.9	-54.9	-54.9	-54.9
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the center of the quiet zone. Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation					

A.5.5.8.2.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with both SSB0 and SSB1.

After receiving RRC command in slot n, UE shall be able to start receiving on TCI state 1 after n+ $T_{RRC\_processing}$ + $T_{first\text{-}SSB}$ + 2ms.

A.5.6 Measurement procedure

A.5.6.1 Intra-frequency Measurements

A.5.6.1.1 EN-DC event triggered reporting test without gap under non-DRX

A.5.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.1.1-1.

Table A.5.6.1.1.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.6.1.1.1-2, A.5.6.1.1.1-3 and A.5.6.1.1.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

Table A.5.6.1.1.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)	
Neighbour cell		1~4	Cell 3	Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3	One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
SMTC configuration		1~4	SMTC.1	
A3-Offset	dB	1~4	-6	
CP length		1~4	Normal	
Hysteresis	dB	1~4	0	
Time To Trigger	s	1~4	0	
Filter coefficient		1~4	0	L3 filtering is not used
DRX		1~4	OFF	
Time offset between Cell 1 and Cell 2		1~4	3 μs	Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μs	Synchronous cells
T1	s	1~4	5	
T2	s	1~4	5	

Table A.5.6.1.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1~4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1~4	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1~4	SSB		SSB	
PDSCH RMC configuration		1~4	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1~4	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1~4	CCR.3.1 TDD		CCR.3.1 TDD	
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120		120	
OCNG Patterns		1~4	OP.1		OP.1	
TRS configuration		1~4	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1~4	TCI.State.2		N/A	
SSB configuration		1, 2	SSB.3 FR2		SSB.3 FR2	
		3, 4	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1~4	AWGN			

Table A.5.6.1.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Assumption for UE beams Note 4		1~4	Rough		Rough	
	dB	1~4	4	4	-Infinity	8
N_{oc} Note 2	dBm/15 KHz	1~4	-102			
N_{oc} Note 2	dBm/SCS	1, 2	-93			
		3, 4	-90			
SS-RSRP	dBm/SCS	1, 2	-89	-89	-Infinity	-85
		3, 4	-86	-86	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1~4	4	4	-Infinity	8
Io	dBm/95.04MHz	1~4	-58.56		-55.38	

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.5.6.1.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 2.4s for a UE supporting power class 1,
- 1.44s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.1.2 EN-DC event triggered reporting test without gap under DRX

A.5.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.2.1-1.

Table A.5.6.1.2.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.6.1.2.1-2 ~ Table A.5.6.1.2.1-6 below.

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.1.2.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)		
Neighbour cell		1~4	Cell 3		Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3		One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
SMTC configuration		1~4	SMTC.1		
A3-Offset	dB	1~4	-6		
CP length		1~4	Normal		
Hysteresis	dB	1~4	0		
Time To Trigger	s	1~4	0		
Filter coefficient		1~4	0		L3 filtering is not used
DRX		1~4	DRX.1	DRX.2	DRX related parameters are defined in Table A.5.6.1.2.1-4
Time offset between Cell 1 and Cell 2		1~4	3 µs		Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 µs		Synchronous cells
T1	s	1~4	5		
T2	s	1~4	10	52	

Table A.5.6.1.2.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1~4	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1~4	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1~4	SSB		SSB	
PDSCH RMC configuration		1~4	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1~4	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1~4	CCR.3.1 TDD		CCR.3.1 TDD	
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120		120	
OCNG Patterns		1~4	OP.1		OP.1	
PDSCH/PDCCH TCI state		1~4	TCI.State.2		N/A	
TCI state		1~4	CSI-RS.Config.0		N/A	
SSB configuration		1, 2	SSB.3 FR2		SSB.3 FR2	
		3, 4	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1~4	AWGN			

Table A.5.6.1.2.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 1 defined in A.3.15.1			
Assumption for UE beams Note 4		1~4	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1~4	4	-1.46	-Infinity	-1.46
N_{oc} Note 2	dBm/15 KHz	1~4	-98			
N_{oc} Note 2	dBm/SCS	1, 2	-89			
		3, 4	-86			
SS-RSRP	dBm/SCS	1, 2	-85	-85	-Infinity	-85
		3, 4	-82	-82	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1~4	4	4	-Infinity	4
Io	dBm/95.04MHz	1~4	-54.53	-52.18	-54.53	-52.18
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.						

A.5.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2s for a UE supporting power class 1,
- 4.32s for a UE supporting power class 2, 3 and 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2s for a UE supporting power class 1,
- 30.72s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.1.3 EN-DC event triggered reporting test with per-UE gaps under non-DRX

A.5.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.3.1-1.

Table A.5.6.1.3.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.6.1.3.1-2 ~ 4 below.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

Table A.5.6.1.3.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)	
Neighbour cell		1~4	Cell 3	Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3	One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
Gap type		1~4	Per-UE gaps	
Measurement gap repitition periodicity	ms	1~4	40	
Measurement gap length	ms	1~4	6	
Measurement gap offset	ms	1~4	39	
SMTC configuration		1~4	SMTC.1	
CSI-RS parameters		1~4	CSI-RS.3.2 TDD	
A3-Offset	dB	1~4	-6	
CP length		1~4	Normal	
Hysteresis	dB	1~4	0	
Time To Trigger	s	1~4	0	
Filter coefficient		1~4	0	L3 filtering is not used
DRX		1~4	OFF	
Time offset between Cell 1 and Cell 2		1~4	3 μs	Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μs	Synchronous cells
T1	s	1~4	5	
T2	s	1~4	5	

Table A.5.6.1.3.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1~4	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1~4	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1~4	CSI-RS		SSB	
PDSCH RMC configuration		1~4	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1~4	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1~4	CCR.3.1 TDD		CCR.3.1 TDD	
TRS configuration		1~4	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1~4	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120		120	
OCNG Patterns		1~4	OP.1		OP.1	
SSB		1, 2	SSB.3 FR2		SSB.3 FR2	
		3, 4	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1~4	AWGN			

Table A.5.6.1.3.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Assumption for UE beams Note 4		1~4	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1~4	4	4	-Infinity	8
N_{oc} Note 2	dBm/15 KHz	1~4	-102			
N_{oc} Note 2	dBm/SCS	1, 2	-93			
		3, 4	-90			
SS-RSRP	dBm/SCS	1, 2	-89	-89	-Infinity	-85
		3, 4	-86	-86	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1~4	4	4	-Infinity	8
Io	dBm/95.04MHz	1~4	-58.56		-55.38	

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.5.6.1.3.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3.2s for a UE supporting power class 1,
- 1.92s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.1.4 EN-DC event triggered reporting test with per-UE gaps under DRX

A.5.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.5.6.1.4.1-1.

Table A.5.6.1.4.1-1: supported test configurations

Configuration	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on the same frequency as the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.6.1.4.1-2 ~ 6.

During the test, Cell 2 and Cell 3 are transmitted from the direction determined according to A3.8.

There are two BWPs configured in Cell 2, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 2. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of cell 3.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.1.4.1-2: General test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1~4	E-UTRAN PCell (Cell 1) PSCell (Cell 2)		
Neighbour cell		1~4	Cell 3		Cell to be identified.
RF Channel Number		1~4	1: Cell 1 2: Cell 2 and Cell 3		One TDD carrier frequency is used for the NR cells and one TDD or FDD carrier frequency is used for E-UTRAN cell.
Gap type		1~4	Per-UE gaps		
Measurement gap repitition periodicity	ms	1~4	40		
Measurement gap length	ms	1~4	6		
Measurement gap offset	ms	1~4	39		
SMTC configuration		1~4	SMTC.1		
CSI-RS parameters		1~4	CSI-RS.3.2 TDD		
A3-Offset	dB	1~4	-6		
CP length		1~4	Normal		
Hysteresis	dB	1~4	0		
Time To Trigger	s	1~4	0		
Filter coefficient		1~4	0		L3 filtering is not used
DRX		1~4	DRX.1	DRX.2	DRX related parameters are defined in Table A.5.6.1.4.1-5
Time offset between Cell 1 and Cell 2		1~4	3 μs		Synchronous EN-DC
Time offset between Cell 2 and Cell 3		1~4	3 μs		Synchronous cells
T1	s	1~4	5		
T2	s	1~4	10	52	

Table A.5.6.1.4.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
TDD configuration		1~4	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1~4	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Intial BWP configuration		1~4	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1~4	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1~4	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1~4	CSI-RS		SSB	
PDSCH RMC configuration		1~4	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1~4	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1~4	CCR.3.1 TDD		CCR.3.1 TDD	
TRS configuration		1~4	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI state		1~4	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1~4	120		120	
OCNG Patterns		1~4	OP.1		OP.1	
SSB		1, 2	SSB.3 FR2		SSB.3 FR2	
		3, 4	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1~4	AWGN			

Table A.5.6.1.4.1-4: NR Cell specific test parameters for intra-frequency event triggered reporting for EN-DC with TDD PSCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		1~4	Setup 1 defined in A.3.15.1			
Assumption for UE beams Note 4		1~4	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1~4	4	-1.46	-Infinity	-1.46
N_{oc} Note 2	dBm/15 KHz	1~4	-98			
N_{oc} Note 2	dBm/SCS	1, 2	-89			
		3, 4	-86			
SS-RSRP	dBm/SCS	1, 2	-85	-85	-Infinity	-85
		3, 4	-82	-82	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1~4	4	4	-Infinity	4
Io	dBm/95.04MHz	1~4	-54.53	-52.18	-54.53	-52.18

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

Table A.5.6.1.4.1-5: Void

Table A.5.6.1.4.1-6: Void

A.5.6.1.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2s for a UE supporting power class 1,
- 4.32s for a UE supporting power class 2, 3 and 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.20s for a UE supporting power class 1,
- 30.72s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2 Inter-frequency Measurements

A.5.6.2.1 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is not used

A.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.1.1-1, A.5.6.2.1.1-2, and A.5.6.2.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.1.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.5.6.2.1.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.1.1-1.

Table A.5.6.2.1.1-1 EN-DC event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.5.6.2.1.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2	1, 2		Two FR2 NR carrier frequencies are used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39	39	
SMTC-SSB parameters		Config 1,2	SSB.3 FR2		As specified in clause A.3.10.2
A3-Offset	dB	Config 1,2	[-30]		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs		Synchronous cells.
T1	s	Config 1,2	5		
T2	s	Config 1,2	5.2 for PC1; 3.5 for other PC	5.2 for PC1; 3.5 for other PC	

Table A.5.6.2.1.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 3 as specified in clause A.3.15			
			AoA1		**AoA2**	
Assumption for UE beams$^{\text{Note 7}}$		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW	MHz	Config 1,2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	

Initial UL BWP		Config 1,2	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2	OP.1		OP.1	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
TCI configuration		Config 1,2	CSI-RS.Config.0		NA	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15kHz Note5		NA		NA	
N_{oc} Note2	dBm/SCS Note4	Config 1,2	NA		NA	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2	-87	-87	-Infinity	-87
$\hat{E}_s/I_{ot}$	dB	Config 1,2	NA	NA	-Infinity	NA
$\hat{E}_s/N_{oc}$	dB	Config 1,2	NA	NA	-Infinity	NA
Io Note3	dBm/95.04 MHz Note5	Config 1,2	-87	-87	-Infinity	-87
Propagation Condition		Config 1,2	AWGN			

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5:	Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 6:	As observed with 0dBi gain antenna at the centre of the quiet zone.
Note 7:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.5.6.2.1.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.2 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is used

A.5.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.2.1-1, A.5.6.2.2.1-2, and A.5.6.2.2.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.2.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.5.6.2.2.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.2.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.2.2.1-1 EN-DC event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.5.6.2.2.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2	1				One E-UTRAN TDD carrier frequenciy is used.
NR RF Channel Number		Config 1,2	1, 2				Two FR2 NR carrier frequencies are used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0		13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39		39		
SMTC-SSB parameters		Config 1,2	SSB.3 FR2				As specified in clause A.3.10.2
A3-Offset	dB	Config 1,2	-6				
Hysteresis	dB	Config 1,2	0				
CP length		Config 1,2	Normal				
TimeToTrigger	s	Config 1,2	0				
Filter coefficient		Config 1,2	0				L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs				Synchronous cells.
T1	s	Config 1,2	5				
T2	s	Config 1,2	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.5.6.2.2.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 1 as specified in clause A.3.15			
Assumption for UE beams Note 7		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW	MHz	Config 1,2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1			
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2	OP.1		OP.1	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
TCI configuration		Config 1,2	CSI-RS.Config.0		NA	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15kHz Note5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2	-95.7		-95.7	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2	-89.7	-89.7	-Infinity	-86.7

$\hat{E}_s/I_{ot}$	dB	Config 1,2	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2	6	6	-Infinity	9
Io[Note3]	dBm/95.04 MHz Note5	Config 1,2	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1,2	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.5.6.2.2.2 Test Requirements

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.3 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is not used

A.5.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.3.1-1, A.5.6.2.3.1-2, and A.5.6.2.3.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.3.1-1 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.5.6.2.3.1-1 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.3.1-1.

Table A.5.6.2.3.1-1 EN-DC event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.5.6.2.3.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2	1		One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2	1, 2		Two FR2 NR carrier frequencies are used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39	39	
SMTC-SSB parameters		Config 1,2	SSB.3 FR2		As specified in clause A.3.10.2
A3-Offset	dB	Config 1,2	-30		
Hysteresis	dB	Config 1,2	0		
CP length		Config 1,2	Normal		
TimeToTrigger	s	Config 1,2	0		
Filter coefficient		Config 1,2	0		L3 filtering is not used
DRX		Config 1,2	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs		Synchronous cells.
T1	s	Config 1,2	5		
T2	s	Config 1,2	7 for PC1; 4.5 for other PC	7 for PC1; 4.5 for other PC	

Table A.5.6.2.3.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 3 as specified in clause A.3.15			
			AoA1		**AoA2**	
Assumption for UE beams Note 7		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW	MHz	Config 1,2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	DLBWP.0.1			
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
TCI configuration		Config 1,2	CSI-RS.Config.0		NA	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15kHz Note5		NA		NA	
N_{oc} Note2	dBm/SCS Note4	Config 1,2	NA		NA	

SS-RSRP Note 3	dBm/SCS Note5	Config 1,2	-87	-87	-Infinity	-87
$\hat{E}_s/I_{ot}$	dB	Config 1,2	NA	NA	-Infinity	NA
$\hat{E}_s/N_{oc}$	dB	Config 1,2	NA	NA	-Infinity	NA
Io Note3	dBm/95.04 MHz Note5	Config 1,2	-87	-87	-Infinity	-87
Propagation Condition		Config 1,2	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.5.6.2.3.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.4 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is used

A.5.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR2 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.4.1-1, A.5.6.2.4.1-2, and A.5.6.2.4.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.4.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.5.6.2.4.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.2-1. Supported test configurations are shown in table A.5.6.2.4.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.2.4.1-1: EN-DC event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	LTE FDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.5.6.2.4.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2	1				One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2	1, 2				Two FR2 NR carrier frequencies are used.
Active cell		Config 1,2	LTE Cell 1 (PCell) and NR cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2	0		13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2	39		39		
SMTC-SSB parameters		Config 1,2	SSB.3 FR2				As specified in clause A.3.10.2
A3-Offset	dB	Config 1,2	-6				
Hysteresis	dB	Config 1,2	0				
CP length		Config 1,2	Normal				
TimeToTrigger	s	Config 1,2	0				
Filter coefficient		Config 1,2	0				L3 filtering is not used
DRX		Config 1,2	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,2	3μs				Synchronous cells.
T1	s	Config 1,2	5				
T2	s	Config 1,2	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	

Table A.5.6.2.4.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2	Setup 1 as specified in clause A.3.15			
Assumption for UE beams Note 7		Config 1,2	Rough		Rough	
NR RF Channel Number		Config 1,2	1		2	
Duplex mode		Config 1,2	TDD		TDD	
$BW_{channel}$	MHz	Config 1,2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW	MHz	Config 1,2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
TDD configuration		Config 1,2	TDDConf.3.1		TDDConf.3.1	
Initial DL BWP		Config 1,2	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2	ULBWP.0.1			
Dedicated DL BWP		Config 1,2	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,2	SR.3.1 TDD		-	
CORESET Reference Channel		Config 1,2	CR.3.1 TDD		-	
TRS configuration		Config 1,2	TRS.2.1 TDD		NA	
TCI configuration		Config 1,2	CSI-RS.Config.0		NA	
SMTC configuration defined in A.3.11		Config 1,2	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2	120		120	
EPRE ratio of PSS to SSS		Config 1,2	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz Note5		-104.7		-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2	-95.7		-95.7	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2	6	6	-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2	6	6	-Infinity	9

Io[Note3]	dBm/95.04 MHz Note5	Config 1,2	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1,2	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.5.6.2.4.2 Test Requirements

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.5 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is not used

A.5.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.5.1-1, A.5.6.2.5.1-2, and A.5.6.2.5.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.5.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.5.6.2.5.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.5.6.2.5.1-1.

Table A.5.6.2.5.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
Note: The UE is only required to be tested in one of the supported test configurations		

Table A.5.6.2.5.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		One FR1 and one FR2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39	39	
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1		As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2		As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3,4,5,6	6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6	-120		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms		Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	5.2 for PC1; 3.5 for other PC	5.2 for PC1; 3.5 for other PC	

Table A.5.6.2.5.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1 as specified in clause A.3.15	
Assumption for UE beams Note 7		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 2,5	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 3,6	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 2,5	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 3,6	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1	
		Config 3,6	TDDConf.2.1		TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2		SMTC.2	
		Config 2,3,5,6	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120	
		Config 3,6	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						

N_{oc} Note2	dBm/15 kHz Note5		NA Link only, see clause A.3.7A	NA	
N_{oc} Note2	dBm/SCS Note4	Config 1,2,4,5		NA	
		Config 3,6		NA	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2,4,5		-Infinity	-87
		Config 3,6		-Infinity	-87
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6		-Infinity	NA
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6		-Infinity	NA
Io Note3	dBm/9.36MHz	Config 1,2,4,5		-	-
	dBm/38.16MHz	Config 3,6		-	-
	dBm/95.04 MHz Note5	Config 1,2,3,4,5,6		-Infinity	-87
Propagation Condition		Config 1,2,3,4,5,6		AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.2.5.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.6 EN-DC event triggered reporting tests for FR2 cell without SSB time index detection when DRX is used

A.5.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.6.1-1, A.5.6.2.6.1-2, and A.5.6.2.6.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.6.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.5.6.2.6.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.5.6.2.6.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.2.6.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
Note: The UE is only required to be tested in one of the supported test configurations		

Table A.5.6.2.6.1-2: General test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1				One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2				One FR1 and one Fr2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.

Neighbour cell		Config 1,2,3,4,5,6	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39		39		
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1				As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1				As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2				As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3,4,5,6	6				
Hysteresis	dB	Config 1,2,3,4,5,6	0				
a4-Threshold	dBm	Config 1,2,3,4,5,6	-120				
CP length		Config 1,2,3,4,5,6	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6	0				
Filter coefficient		Config 1,2,3,4,5,6	0				L3 filtering is not used
DRX		Config 1,2,3,4,5,6	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms				Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs				Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5				
T2	s	Config 1,2,3,4,5,6	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.5.6.2.6.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting without SSB time index detection

Parameter	Unit	Test configuration	Cell 2		Cell 3	
			T1	T2	T1	T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1 as specified in clause A.3.15	
Assumption for UE beams Note 7		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 2,5	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 3,6	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	

BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66	
		Config 2,5	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66	
		Config 3,6	40: $N_{RB,c}$ = 106	100: $N_{RB,c}$ = 66	
TDD configuration		Config 2,5	TDDConf.1.1	TDDConf.3.1	
		Config 3,6	TDDConf.2.1	TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1	NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1	NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1	NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1	NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1	OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD	-	
		Config 2,5	SR.1.1 TDD		
		Config 3,6	SR2.1 TDD		
CORESET Reference Channel		Config 1,4	CR.1.1 FDD	-	
		Config 2,5	CR.1.1 TDD		
		Config 3,6	CR2.1 TDD		
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2	SMTC.2	
		Config 2,3,5,6	SMTC.1	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15	120	
		Config 3,6	30	120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	dBm/15 kHz Note5		NA Link only, see clause A.3.7A	-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2,4,5		-95.7	
		Config 3,6		-95.7	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2,4,5		-Infinity	-86.7
		Config 3,6		-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6		-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6		-Infinity	9
Io Note3	dBm/9.36MHz	Config 1,2,4,5		-	-

	dBm/38.16MHz	Config 3,6		-	-
	dBm/95.04 MHz Note5	Config 1,2,3,4,5,6		-66.7	-57.2
Propagation Condition		Config 1,2,3,4,5,6		AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.2.6.2 Test Requirements

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.7 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is not used

A.5.6.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.7.1-1, A.5.6.2.7.1-2, and A.5.6.2.7.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.7.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #13 as defined in Table A.5.6.2.7.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.5.6.2.7.1-1.

Table A.5.6.2.7.1-1: EN-DC event triggered reporting tests with SSB index reading for FR1-FR2

<table>
<tr><th>Config</th><th>Description of serving cell</th><th>Description of target cell</th></tr>
<tr><td>1</td><td>LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode</td><td rowspan="6">120 kHz SSB SCS,
100 MHz bandwidth, TDD duplex mode</td></tr>
<tr><td>2</td><td>LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode</td></tr>
<tr><td>3</td><td>LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode</td></tr>
<tr><td>4</td><td>LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode</td></tr>
<tr><td>5</td><td>LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode</td></tr>
<tr><td>6</td><td>LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode</td></tr>
<tr><td colspan="3">Note: The UE is only required to be tested in one of the supported test configurations</td></tr>
</table>

Table A.5.6.2.7.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value Test 1	Value Test 2	Comment
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN TDD carrier frequency is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2		One FR1 and one FR2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)		LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3		NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39	39	
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1		As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2		As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3,4,5,6	6		
Hysteresis	dB	Config 1,2,3,4,5,6	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6	-120		
CP length		Config 1,2,3,4,5,6	Normal		
TimeToTrigger	s	Config 1,2,3,4,5,6	0		
Filter coefficient		Config 1,2,3,4,5,6	0		L3 filtering is not used
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 μs		Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms		Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3μs		Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5		
T2	s	Config 1,2,3,4,5,6	7 for PC1; 4.5 for other PC	7 for PC1; 4.5 for other PC	

Table A.5.6.2.7.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2 T1	Cell 2 T2	Cell 3 T1	Cell 3 T2

AoA setup		Config 1,2,3,4,5,6	NA	Setup 1 as specified in clause A.3.15
Assumption for UE beams Note 7		Config 1,2,3,4,5,6	N/A	Rough
NR RF Channel Number		Config 1,2,3,4,5,6	1	2
Duplex mode		Config 1,4	FDD	TDD
		Config 2,3,5,6	TDD	TDD
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66
		Config 2,5	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66
		Config 3,6	40: $N_{RB,c}$ = 106	100: $N_{RB,c}$ = 66
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66
		Config 2,5	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66
		Config 3,6	40: $N_{RB,c}$ = 106	100: $N_{RB,c}$ = 66
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1	OP.1
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD	-
		Config 2,5	SR.1.1 TDD	
		Config 3,6	SR2.1 TDD	
CORESET Reference Channel		Config 1,4	CR.1.1 FDD	-
		Config 2,5	CR.1.1 TDD	
		Config 3,6	CR2.1 TDD	
TDD configuration		Config 2,5	TDDConf.1.1	TDDConf.3.1
		Config 3,6	TDDConf.2.1	TDDConf.3.1
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1	NA
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1	NA
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1	NA
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1	NA
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2	SMTC.2
		Config 2,3,5,6	SMTC.1	SMTC.1
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15	120
		Config 3,6	30	120
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz Note5			NA

N_{oc} Note2	dBm/SCS Note4	Config 1,2,4,5	NA Link only, see clause A.3.7A	NA	
		Config 3,6		NA	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2,4,5		-Infinity	-87
		Config 3,6		-Infinity	NA
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6		-Infinity	NA
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6		-Infinity	-87
Io Note3	dBm/9.36MHz	Config 1,2,4,5		-	-
	dBm/38.16MHz	Config 3,6		-	-
	dBm/95.04 MHz Note5	Config 1,2,3,4,5,6		-Infinity	-87
Propagation Condition		Config 1,2,3,4,5,6		AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.2.7.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.2.8 EN-DC event triggered reporting tests for FR2 cell with SSB time index detection when DRX is used

A.5.6.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the EN-DC inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are three cells: LTE cell 1 as PCell on E-UTRA RF channel 1, NR cell 2 as PSCell in FR1 on NR RF channel 1 and NR cell 3 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.5.6.2.8.1-1, A.5.6.2.8.1-2, and A.5.6.2.8.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.5.6.2.8.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #13 as defined in Table A.5.6.2.8.1-2 is provided for UE that support per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

The configuration of LTE cell 1 is defined in table A.3.7.2.1-1. Supported test configurations are shown in table A.5.6.2.8.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.5.6.2.8.1-1: EN-DC event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
Note: The UE is only required to be tested in one of the supported test configurations		

Table A.5.6.2.8.1-2: General test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1				One E-UTRAN TDD carrier frequenciy is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1, 2				One FR1 and one FR2 NR carrier frequency is used.
Active cell		Config 1,2,3,4,5,6	LTE Cell 1 (PCell) and NR cell 2 (PScell)				LTE Cell 1 is on E-UTRA RF channel number 1. NR Cell 2 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	NR cell 3				NR cell 3 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3,4,5,6	0		13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3,4,5,6	39		39		
SMTC-SSB parameters on NR RF Channel 1		Config 1,4	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1				As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1				As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3,4,5,6	SSB.3 FR2				As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3,4,5,6	6				
Hysteresis	dB	Config 1,2,3,4,5,6	0				
a4-Threshold	dBm	Config 1,2,3,4,5,6	-120				
CP length		Config 1,2,3,4,5,6	Normal				
TimeToTrigger	s	Config 1,2,3,4,5,6	0				
Filter coefficient		Config 1,2,3,4,5,6	0				L3 filtering is not used
DRX		Config 1,2,3,4,5,6	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between PCell and PSCell		Config 1,2,3,4,5,6	3 µs				Synchronous EN-DC
Time offset between serving and neighbour cells		Config 1,4	3ms				Asynchronous cells. The timing of Cell 3 is 3ms later than the timing of Cell 2.
		Config 2,3,5,6	3µs				Synchronous cells.
T1	s	Config 1,2,3,4,5,6	5				
T2	s	Config 1,2,3,4,5,6	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	

Table A.5.6.2.8.1-3: Cell specific test parameters for EN-DC inter-frequency event triggered reporting with SSB time index detection

Parameter	Unit	Test configuration	Cell 2 T1	Cell 2 T2	Cell 3 T1	Cell 3 T2
AoA setup		Config 1,2,3,4,5,6	NA		Setup 1 as specified in clause A.3.15	
Assumption for UE beams Note 7		Config 1,2,3,4,5,6	N/A		Rough	
NR RF Channel Number		Config 1,2,3,4,5,6	1		2	
Duplex mode		Config 1,4	FDD		TDD	
		Config 2,3,5,6	TDD		TDD	
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 2,5	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 3,6	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP BW	MHz	Config 1,4	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 2,5	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
		Config 3,6	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		Config 1,2,3,4,5,6	OP.1		OP.1	
PDSCH Reference measurement channel		Config 1,4	SR.1.1 FDD		-	
		Config 2,5	SR.1.1 TDD			
		Config 3,6	SR2.1 TDD			
CORESET Reference Channel		Config 1,4	CR.1.1 FDD		-	
		Config 2,5	CR.1.1 TDD			
		Config 3,6	CR2.1 TDD			
TDD configuration		Config 2,5	TDDConf.1.1		TDDConf.3.1	
		Config 3,6	TDDConf.2.1		TDDConf.3.1	
Initial DL BWP		Config 1,2,3,4,5,6	DLBWP.0.1		NA	
Initial UL BWP		Config 1,2,3,4,5,6	ULBWP.0.1		NA	
Dedicated DL BWP		Config 1,2,3,4,5,6	DLBWP.1.1		NA	
Dedicated UL BWP		Config 1,2,3,4,5,6	ULBWP.1.1		NA	
SMTC configuration defined in A.3.11		Config 1,4	SMTC.2		SMTC.2	
		Config 2,3,5,6	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15		120	
		Config 3,6	30		120	
EPRE ratio of PSS to SSS		Config 1,2,3,4,5,6	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						

EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS(Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	dBm/15 kHz Note5		NA Link only, see clause A.3.7A	-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2,4,5		-95.7	
		Config 3,6		-95.7	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2,4,5		-Infinity	-86.7
		Config 3,6		-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6		-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6		-Infinity	9
Io Note3	dBm/9.36MHz	Config 1,2,4,5		-	-
	dBm/38.16MHz	Config 3,6		-	-
	dBm/95.04 MHz Note5	Config 1,2,3,4,5,6		-66.7	-57.2
Propagation Condition		Config 1,2,3,4,5,6		AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 6: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.2.8.2 Test Requirements

In test 1 with per-UE gap and in test 3 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.3 L1-RSRP measurement for beam reporting

A.5.6.3.1 SSB based L1-RSRP measurement when DRX is not used

A.5.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in Table A.5.6.3.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.5.6.3.1.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.5.6.3.1.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.6.3.1.2-1 and Table A.5.6.3.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.5.6.3.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~4		freq1
Duplex mode	1~4		TDD
TDD Configuration	1~4		TDDConf.3.1
$BW_{channel}$	1~4	MHz	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~4		SR.3.1 TDD
RMSI CORESET Reference Channel	1~4		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~4		CCR.3.1 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~4		SMTC.1
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
DRX configuration	1~4		Off
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	640
T1	1~4	s	5
T2	1~4	s	2
Propagation condition	1~4		AWGN
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS[Note 1]			
EPRE ratio of OCNG to OCNG DMRS [Note 1]			
Propagation condition	1~4		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.3.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Assumption for UE beams Note 4	1~4		Rough			
N_{oc} Note2	1~4	dBm/15kHz	-105			
N_{oc} Note2	1,2	dBm/SSB SCS	-96			
	3,4		-93			
$\hat{E}_s/I_{ot}$	1~4	dB	0	0	-Infinity	9
SSB RSRP Note3	1,2	dBm/SSB SCS	-96	-96	-Infinity	-87
	3,4		-93	-93	-Infinity	-84
Io Note3	1,2	dBm/95.04MHz	-67.5	-67.5	-71.1	-60.7
	3,4		-67.5	-67.5	-71.1	-60.7
$\hat{E}_s/N_{oc}$	1~4	dB	0	0	-Infinity	9

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.6.3.1.3 Test Requirements

The UE shall send L1-RSRP report every 640 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 1680 for UE supporting power class 1
- 1200 for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI$_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.3.2 SSB based L1-RSRP measurement when DRX is used

A.5.6.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in Table A.5.6.3.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.5.6.3.2.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.5.6.3.2.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.6.3.2.2-1 and Table A.5.6.3.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.5.6.3.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~4		freq1
Duplex mode	1~4		TDD
TDD Configuration	1~4		TDDConf.3.1
$BW_{channel}$	1~4	MHz	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~4		SR.3.1 TDD
RMSI CORESET Reference Channel	1~4		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~4		CCR.3.1 TDD
SSB configuration	1,2		SSB.1 FR2
	3,4		SSB.2 FR2
OCNG Patterns	1~4		OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~4		SMTC.1
TRS Configuration	1~4		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2
DRX configuration	1~4		DRX.3
reportConfigType	1~4		periodic
reportQuantity	1~4		ssb-Index-RSRP
Number of reported RS	1~4		2
L1-RSRP reporting period	1~4	slot	640
T1	1~4	s	5
T2	1~4	s	3
Propagation condition	1~4		AWGN
EPRE ratio of PSS to SSS	1~4	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~4		AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.3.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Assumption for UE beams[Note 4]	1~4		Rough			
N_{oc} Note2	1~4	dBm/15kHz	-105			
N_{oc} Note2	1,2	dBm/SSB SCS	-96			
	3,4		-93			
$\hat{E}_s/I_{ot}$	1~4	dB	0	0	-Infinity	9
SSB RSRP Note3	1,2	dBm/SSB SCS	-96	-96	-Infinity	-87
	3,4		-93	-93	-Infinity	-84
Io Note3	1,2	dBm/95.04MHz	-67.5	-67.5	-71.1	-60.7
	3,4		-67.5	-67.5	-71.1	-60.7
$\hat{E}_s/N_{oc}$	1~4	dB	0	0	-Infinity	9

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.5.6.3.2.3 Test Requirements

The UE shall send L1-RSRP report every 640 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 2880 for UE supporting power class 1
- 1920 for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.3.3 CSI-RS based L1-RSRP measurement when DRX is not used

A.5.6.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in Table A.5.6.3.3.1-1.

Table A.5.6.3.3.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.5.6.3.3.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.6.3.3.2-1 and Table A.5.6.3.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 480ms from the beginning of the test, the DCI trigger comes in slot 8 of a frame and UE provides the report back based on the reporting configuration as defined in Table A.5.6.3.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.5.6.3.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		Off
reportConfigType	1~2		aperiodic
reportQuantity	1~2		cri-RSRP
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~2		26
Propagation condition	1~2		AWGN
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.3.3.2-1: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1~2		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4	1~2		Rough	
N_{oc} Note1	1~2	dBm/15kHz	-105	
N_{oc} Note1	1~2	dBm/SSB SCS	-95.97	
$\hat{E}_s/I_{ot}$	1~2	dB	0	9
CSI-RS RSRP Note2	1~2	dBm/SSB SCS	-95.97	-86.97
Io Note2	1~2	dBm/95.04MHz	-63.97	-57.47
$\hat{E}_s/N_{oc}$	1~2	dB	0	9
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.5.6.3.3.3 Test Requirements

After 480ms from the beginning of the test, the UE shall send L1-RSRP report at slot 26 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.5.6.3.3.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.2.2-1.

Table A.5.6.3.3.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}
Note 1: CSI-RS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.3.4 CSI-RS based L1-RSRP measurement when DRX is used

A.5.6.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in Table A.5.6.3.4.1-1.

Table A.5.6.3.4.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.5.6.3.4.2 Test parameters

There are two cells in the test, E-UTRAN PCell (Cell 1) and FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.6.3.4.2-1 and Table A.5.6.3.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 1440ms from the beginning of the test, the DCI trigger comes in slot 8 of a frame and UE provides the report back based on the reporting configuration as defined in Table A.5.6.3.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.5.6.3.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2
CSI-RS configuration	1~2		CSI-RS.3.3 TDD
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		aperiodic
reportQuantity	1~2		cri-RSRP
Number of reported RS	1~2		2
qcl-Info	1~2		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1~2		26
Propagation condition	1~2		AWGN
T1	1~2	s	5
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.5.6.3.4.2-1: CSI-RS specific test parameters

<table>
<tr><th>Parameter</th><th>Config</th><th>Unit</th><th>CSI-RS#0</th><th>CSI-RS#1</th></tr>
<tr><td>Angle of arrival configuration</td><td>1~2</td><td></td><td colspan="2">Setup 1 according to A.3.15.1</td></tr>
<tr><td>Assumption for UE beams Note 4</td><td>1~2</td><td></td><td colspan="2">Rough</td></tr>
<tr><td>N_{oc} Note1</td><td>1~2</td><td>dBm/15kHz</td><td colspan="2">-105</td></tr>
<tr><td>N_{oc} Note1</td><td>1~2</td><td>dBm/SSB SCS</td><td colspan="2">-95.97</td></tr>
<tr><td>$\hat{E}_s/I_{ot}$</td><td>1~2</td><td>dB</td><td>0</td><td>9</td></tr>
<tr><td>CSI-RS RSRP Note2</td><td>1~2</td><td>dBm/SSB SCS</td><td>-95.97</td><td>-86.97</td></tr>
<tr><td>Io Note2</td><td>1~2</td><td>dBm/95.04MHz</td><td>-63.97</td><td>-57.47</td></tr>
<tr><td>$\hat{E}_s/N_{oc}$</td><td>1~2</td><td>dB</td><td>0</td><td>9</td></tr>
<tr><td colspan="5">Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation</td></tr>
</table>

A.5.6.3.4.3 Test Requirements

After 1440ms from the beginning of the test, the UE shall send L1-RSRP report at slot 26 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range of [-10 ~ +20] dB.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.5.6.3.4.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.2.2-1.

Table A.5.6.3.4.3-1: L1-RSRP absolute accuracy test requirement

<table>
<tr><th></th><th>Test requirement Notes1,2,3</th></tr>
<tr><td>CSI-RS0</td><td>CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}</td></tr>
<tr><td>CSI-RS1</td><td>CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}</td></tr>
<tr><td colspan="2">Note 1: CSI-RS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration
Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test
Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class</td></tr>
</table>

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.4 CLI measurements

A.5.6.4.1 SRS-RSRP measurement with DRX

A.5.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SRS-RSRP measurement. This test will verify the SRS-RSRP measurement requirements in clause 9.7.2.5 with the testing configurations for NR cells in Table A.5.6.4.1.1-1.

Table A.5.6.4.1.1-1: Applicable NR configurations for FR2 SRS-RSRP test

Configuration	Description
1	NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode

A.5.6.4.1.2 Test Parameters

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2). The test parameters for PSCell is given in Table A.5.6.4.1.2-1 ~ A.5.6.4.1.2-3 below and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in Table A.5.6.4.1.2-4 and the test parameters for the (virtual) neighbour cell UE in Table A.5.6.4.1.2-3. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

Table A.5.6.4.1.2-1: General test parameters for SRS-RSRP event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	E-UTRAN Cell 1 and NR Cell 2	
RF Channel Number		1	1: Cell 1 2: Cell 2	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.1	
SRS configuration		1	SRSConf.1	Table A.5.6.4.1.2-4
CP length		1	Normal	
i1-Threshold	dBm	1	-103	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX	ms	1	DRX.11	
Time offset between DL from serving cell and SRS from test system	µs	1,2	10.67	
T1	s	1	5	
T2	s	1	1	

Table A.5.6.4.1.2-2: NR Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns		1	OP.1	
TRS configuration			TRS.2.1. TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
Propagation Condition		1	AWGN	

Table A.5.6.4.1.2-3: NR OTA Cell specific test parameters for SRS-RSRP event triggered reporting for PSCell and Neighbour cell UE in FR2

Parameter	Unit	Test configuration	Cell 2		Neighbour cell UE	
			T1	T2	T1	T2
AoA setup		1	Setup 1 defined A.3.15.1			
Beam assumption Note 4		1	Fine			
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
N_{oc} Note 2	dBm/SCS	1	-89		-89	
$\hat{E}_s/I_{ot}$	dB	1	-	-	-infinity	4
$\hat{E}_s/N_{oc}$	dB	1	-	-	-infinity	4
SRS-RSRP Note 3	dBm/SCS kHz	1	-	-	-infinity	-94
Io	dBm/95.04 MHz	1	-70.01	-68.82	-70.01	-68.82

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

Table A.5.6.4.1.2-4: SRS configuration for measurement reporting

	Field	SRSConf.1	Comments
SRS-ResourceSet	srs-ResourceSetId	0	
	srs-ResourceIdList	0	
	resourceType	Periodic	
	Usage	Codebook	
SRS-Resource	SRS-ResourceId	0	
	nrofSRS-Ports	Port1	
	transmissionComb	n2	
	combOffset-n2	0	
	cyclicShift-n2	0	
	resourceMapping startPosition	0	
	resourceMapping nrofSymbols	n1	
	resourceMapping repetitionFactor	n1	
	freqDomainPosition	0	
	freqDomainShift	0	
	freqHopping c-SRS	12	
	freqHopping b-SRS	0	
	freqHopping b-hop	0	
	groupOrSequenceHopping	Neither	
	resourceType	Periodic	
	periodicityAndOffset	sl160, 25	
	sequenceId	0	Any 10 bit number

A.5.6.4.1.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 60 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.6.4.2 CLI-RSSI measurement with DRX

A.5.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of CLI-RSSI measurement. This test will verify the CLI-RSSI measurement requirements in clause 9.7.3.5 with the testing configurations for NR cells in Table A.5.6.4.2.1-1.

Table A.5.6.4.2.1-1: Applicable NR configurations for FR2 CLI-RSSI test

Configuration	Description
1	NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode

A.5.6.4.2.2 Test Parameters

Two cells are deployed in the test, which are E-UTRAN PCell (Cell 1) and FR2 PSCell (Cell 2). The test parameters for PSCell is given in Table A.5.6.4.2.2-1 ~ A.5.6.4.2.2-3 below and applicability for the E-UTRAN cell are defined in A.3.7.2. In the measurement control information, a measurement object is configured for the frequency of the PSCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI measurement resource and on 2 data symbols before. The CLI-RSSI measurement resource configuration is in Table A.5.6.4.2.2-4.

Table A.5.6.4.2.2-1: General test parameters for CLI-RSSI event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	E-UTRAN Cell 1 and NR Cell 2	
RF Channel Number		1	1: Cell 1 2: Cell 2	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.1	
CLI-RSSI configuration		1	CLI-RSSIConf.1	Table A.5.6.4.2.2-4
CP length		1	Normal	
i1-Threshold	dBm	1	-94.5	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	DRX.11	
Time offset between DL from serving cell and OCNG from test system	μs	1	10.67	
T1	s	1	5	
T2	s	1	1	

Table A.5.6.4.2.2-2: NR Cell specific test parameters for CLI-RSSI event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
PUSCH parameters		1	N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns Note 1		1	OP.1	
TRS configuration			TRS.2.1. TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
Propagation Condition		1	AWGN	
Note 1: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.5.6.4.2.2-3: NR OTA Cell specific test parameters for CLI-RSSI event triggered reporting for PSCell in FR2

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
AoA setup		1	Setup 1 defined in A.3.15.1	
Beam assumption Note 3		1	Fine	
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/15 kHz	1	-119	-108
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/SCS	1	-110	-99
Io on CLI-RSSI measurement resource	dBm/95.04 MHz	1	-81.01	-70.01
Io on CLI-RSSI measurement resource	dBm/1.08 MHz	1	-100.46	-89.46
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.				

Table A.5.6.4.2.2-4: CLI-RSSI measurement resource configuration for measurement reporting

	Field	CLI-RSSIConf.1
RSSI-Resource	rssi-ResourceId	0
	rssi-SCS	120
	startPRB	0
	nrofPRBs	66
	startPosition	3
	nrofSymbols	11
	rssi-PeriodicityAndOffset	sl160, 25

A.5.6.4.2.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 20 ms from the beginning of time period T2. The nominal RSSI used to evaluate the requirement shall be based on Io.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.5.7 Measurement Performance requirements

A.5.7.1 SS-RSRP

A.5.7.1.1 EN-DC intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.5.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.3.1.1 and 10.1.3.1.2 for intra-frequency measurements.

A.5.7.1.1.2 Test parameters

In this set of test cases, all NR cells are on the same carrier frequency. Supported test configurations are shown in Table A.5.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in Table A.5.7.1.1.2-2 and A.5.7.1.1.2-3. The E-UTRA PCell is configured as specified in clause A.3.7.2.2. In all test cases, Cell 1 is the PCell, cell 2 is the PSCell and Cell 3 is the target cell. The test consists of two time phases T1 and T2.

Table A.5.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations	

Table A.5.7.1.1.2-2: SS-RSRP Intra frequency general test parameters

Parameter[Note 5]	Unit	T1		T2	
		Cell 2	Cell 3	Cell 2	Cell 3

Physical cell ID		**489**	**0**	**489**	**0**
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 24		100: $N_{RB,c}$ = 24	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 2	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Void
Note 3: Void
Note 4: Void
Note 5: All parameters apply for configuration 1 and 2
Note 6: Void

Table A.5.7.1.1.2-3: SS-RSRP Intra frequency OTA related test parameters

Parameter	Unit	T1		T2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 8		Rough			
N_{oc} Note1	dBm/15kHz Note4	-91.6		N/A	
N_{oc} Note1	dBm/SCS Note4	-82.6		N/A	
$\hat{E}_s/N_{oc}$	dB	6.0	1.0	N/A	N/A
Es	dBm/SCS Note4			(Table B.2.2-2 Rx Beam Peak +2.1dB)	(Table B.2.2-2 Rx Beam Peak +2.1dB)
SSB_RP Note2	dBm/SCS	-76.6	-81.6	(Table B.2.2-2 Rx Beam Peak +2.1dB)	(Table B.2.2-2 Rx Beam Peak +2.1dB)
$\hat{E}_s/I_{ot\ BB}$ Note6	dB	2.44	-5.98	-5.98	-5.98
Io Note2	dBm/95.04 MHz Note4	-50.05		(Table B.2.2-2 Rx Beam Peak +29.70dB)	

Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: Void
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: Void
Note 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
Note 7: All parameters apply for configurations 1 and 2
Note 8: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.3.1.1 and relative accuracy requirements in clause 10.1.3.1.2. The following requirements are to be verified:

During T1:

Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.5.7.1.1.3-1.

Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 10.1.3.1.2-1.

During T2:

Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.5.7.1.1.3-1.

Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 10.1.3.1.2-1.

During T1 and T2:

Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 10.1.3.1.2-1

Relative accuracy of Cell 3 during T2 compared with Cell 3 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 10.1.3.1.2-1.

Table A.5.7.1.1.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 2	SSB_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP2 +δ +G_{max}
Cell 3	SSB_RP3 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP3 +δ +G_{max}
Note 1: SSB_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.3.1.1-1, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.7.1.2 EN-DC inter-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.5.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.5.1.1 and 10.1.5.1.2 for inter-frequency measurements with the testing configurations for NR cells in Table A.5.7.1.2.1-1.

Table A.5.7.1.2.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test

Configuration	Description
1	FDD LTE PCell, cells 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, cells 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	FDD LTE PCell, cells 2&3 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	TDD LTE PCell, cells 2&3 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

A.5.7.1.2.2 Test parameters

In this set of test cases, there are three cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.7.1.2.2-1 and Table A.5.7.1.2.2-2 below. Both absolute and relative accuracy of RSRP intrer-frequency measurements are tested by using the parameters in Table A.5.7.1.2.2-1 and Table A.5.7.1.2.2-2. The inter-frequency measurements are supported by a measurement gap.

Table A.5.7.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN	1~4		freq1	freq2	freq1	freq2
$BW_{channel}$	1~4		100: $N_{RB,c}$ = 24		100: $N_{RB,c}$ = 24	
Duplex mode	1~4		TDD	TDD	TDD	TDD
TDD configuration	1~4		TDDConf.3.1		TDDConf.3.1	
PDSCH Reference measurement channel	1~4		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel	1~4		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference Channel	1~4		CCR.3.1 TDD	-	CCR.3.1 TDD	-
SSB configuration	1,2		SSB.3 FR2		SSB.3 FR2	
	3,4		SSB.4 FR2		SSB.4 FR2	
PDSCH/PDCCH subcarrier spacing	1~4	kHz	120		120	
OCNG Patterns	1~4		OP.3		OP.3	
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~4		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2		TCI.State.2	
SMTC configuration	1~4		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 3	1~4	μs	3		3	
EPRE ratio of PSS to SSS	1~4	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~4	-	AWGN	AWGN	AWGN	AWGN
Antenna configuration	1~4	-	1x2	1x2	1x2	1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Void						

Table A.5.7.1.2.2-2: SS-RSRP inter frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration	1~4		Setup 4b according to clause A.3.15.4.2		Setup 4b according to clause A.3.15.4.2	
			AoA1 Spherical coverage	AoA2 Rx Beam Peak	AoA1 Spherical coverage	AoA2 Rx Beam Peak
Assumption for UE beams Note 7	1~4		Rough		Rough	
N_{oc} Note1	1, 2	dBm/15kHz Note4	-90.6	-90.6	(Table B.2.3-2 Rx Beam Peak Note 8 +1.97dB)	(Table B.2.3-2 Rx Beam Peak Note 8 -3.03dB)
	3, 4		-92.9	-92.9		
N_{oc} Note1	1, 2	dBm/SCS Note4	-81.6	-81.6	(Table B.2.3-2 Rx Beam Peak Note 8 +11.0dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +6.0dB)
	3, 4		-80.9	-80.9	(Table B.2.3-2 Rx Beam Peak Note 8 +14.0dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +9.0dB)
$\hat{E}_s/N_{oc}$	1~4	dB	6.0	6.0	17.0	-1.0
SSB_RP Note2	1, 2	dBm/SCS	-75.6	-75.6	(Table B.2.3-2 Rx Beam Peak Note 8 +28.0dB)	(Table B.2. 3-2 Rx Beam Peak Note 8 +5.0dB)
	3, 4		-74.9	-74.9	(Table B.2.3-2 Rx Beam Peak Note 8 +31.0dB)	(Table B.2. 3-2 Rx Beam Peak Note 8 +8.0dB)
(SSB_RP$_{Cell 2}$ – SSB_RP$_{Cell 3}$)	1~4	dB	0		23.00	
$\hat{E}_s/I_{ot\ BB}$ Note6	1, 2	dB	5.26	5.96	9.53	-3.46
	3, 4		4.81	5.93		
Io Note2	1, 2	dBm/95.04 MHz Note4	-50.00	-50.00	(Table B.2.3-2 Rx Beam Peak Note 8 +52.68dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +33.13dB)
	3, 4		-50.08	-50.08	(Table B.2.3-2 Rx Beam Peak Note 8 +54.90dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +35.35dB)
(Io$_{freq 1}$ – Io$_{freq 2}$)	1~4	dB	0		19.55	

Note 1:	Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2:	SSB_RP, Es/Iot, Io, ($SSB\_RP_{Cell\ 3}$ – $SSB\_RP_{Cell\ 2}$) and ($Io_{freq\ 2}$ – $Io_{freq\ 1}$) levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3:	Void
Note 4:	Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5:	Void
Note 6:	Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P or ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
Note 7:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
Note 8:	The value in Table B.2.3-2 is the Minimum SSB_RP for SCS_{SSB} = 120 kHz, selected according to the operating band and UE power class, without $\Delta MB_{P,n}$ adjustment.

A.5.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 and Cell 3 shall fulfil the absolute requirements in clause 10.1.5.1.1 and the relative requirements in clause 10.1.5.1.2.

Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table A.5.7.1.2.3-1.

Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in A.5.7.1.2.3-2.

Test 2:

Absolute accuracy of Cell 2 and absolute accuracy of Cell 3. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table A.5.7.1.2.3-1.

Relative accuracy of Cell 3 compared with Cell 2. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in A.5.7.1.2.3-2.

Table A.5.7.1.2.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 2	SSB_RP2 -δ +G_{min} +X ≤ Reported RSRP(dBm) ≤ SSB_RP2 +δ +G_{max}
Cell 3	SSB_RP3 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP3 +δ +G_{max}
Note 1:	SSB_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration
Note 2:	δ is the RSRP absolute accuracy requirement from Table 10.1.5.1.1-1, selected according to the Io used in the test
Note 3:	G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class
Note 4:	X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.

Table A.5.7.1.2.3-2: SS-RSRP relative accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 3 – Cell 2	SSB_RP3 - SSB_RP2 -δ ≤ Reported RSRP(dB) ≤ SSB_RP3 - SSB_RP2 +δ –(X)
Note 1: SSB_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration Note 2: δ is the RSRP relative accuracy requirement from Table 10.1.5.1.2-1 Note 3: Void Note 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	

A.5.7.1.3 EN-DC inter-frequency measurement accuracy with FR1 serving cell and FR2 target cell

A.5.7.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.5.1.1 for inter-frequency measurements with the testing configurations in Table A.5.7.1.3.1-1.

Table A.5.7.1.3.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
Note: The UE is only required to be tested in one of the supported test configurations		

A.5.7.1.3.2 Test parameters

In this set of test cases there are three cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2) and a FR2 neighbour cell (Cell 3) on a different frequency than the PSCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 and Cell 3 are given in Table A.5.7.1.3.2-1 and Table A.5.7.1.3.2-2 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in Table A.5.7.1.3.2-1 and Table A.5.7.1.3.2-2. The inter-frequency measurements are supported by a measurement gap.

Table A.5.7.1.3.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN	1~6		freq1	freq2	freq1	freq2
$BW_{channel}$	1,4	MHz	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66
	2,5		10: $N_{RB,c}$ = 52		10: $N_{RB,c}$ = 52	
	3,6		40: $N_{RB,c}$ = 106		40: $N_{RB,c}$ = 106	
Gap pattern ID			0		0	
Duplex mode	1,4		FDD	TDD	FDD	TDD
	2,5		TDD		TDD	
	3,6		TDD		TDD	
TDD configuration	1,4		N/A	TDDConf. 3.1	N/A	TDDConf. 3.1
	2,5		TDDConf. 1.1		TDDConf. 1.1	
	3,6		TDDConf. 2.1		TDDConf. 2.1	
PDSCH Reference measurement channel	1,4		SR.1.1 FDD	-	SR.1.1 FDD	-
	2,5		SR.1.1 TDD		SR.1.1 TDD	
	3,6		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1,4		CR.1.1 FDD	-	CR.1.1 FDD	-
	2,5		CR.1.1 TDD	-	CR.1.1 TDD	-
	3,6		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1,4		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2,5		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3,6		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1,4		SSB.1 FR1	SSB.1 FR2	SSB.1 FR1	SSB.1 FR2
	2,5		SSB.1 FR1		SSB.1 FR1	
	3,6		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~6		OP.1		OP.1	
Initial BWP Configuration	1~6		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~6		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~6		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~6		TCI.State.2		TCI.State.2	
SMTC configuration	1~6		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 3	1~6	µs	3		3	
EPRE ratio of PSS to SSS	1~6	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~6	-		AWGN		AWGN

Antenna configuration	1~6	-	NA Link only, see clause A.3.7A	1x2	NA Link only, see clause A.3.7A	1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						

Table A.5.7.1.3.2-2: SS-RSRP inter-frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration according to clause A.3.15			NA	Setup 2b	NA	Setup 2b
Assumption for UE beams Note 4			N/A	Rough	N/A	Rough
N_{oc}	1~4	dBm/15 kHz	NA Link only, see clause A.3.7A	-90	NA Link only, see clause A.3.7A	NA
N_{oc}	1,2	dBm/SS B SCS		-80.97		NA
	3,4			-80.97		NA
$\hat{E}_s/I_{ot}$	1~4	dB		-4		NA
SS-RSRP Note1	1,2	dBm/SCS		-84.97		As in Table B.2.3-2
	3,4			-84.97		As in Table B.2.3-2
Io Note1	1~4	dBm/ 95.04MHz		—50.53		SS-RSRP+ 28.98
$\hat{E}_s/N_{oc}$	1~4	dB		-4		NA
Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 3: No additional noise is added by the test system in Test 2. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.5.7.1.3.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 3 shall fulfil the Absolute requirement in clause 10.1.5.1.1.

A.5.7.2 SS-RSRQ

A.5.7.2.1 EN-DC Intra-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.8.1.1.

A.5.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in Table A.5.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in Table A.5.7.2.1.2-2 and Table A.5.7.2.1.2-3. The configuration of cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.5.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations	

Table A.5.7.2.1.2-2: SS-RSRQ Intra frequency test parameters

<table>
<tr><th colspan="2" rowspan="2">Parameter</th><th rowspan="2">Unit</th><th colspan="2">Test 1</th><th colspan="2">Test 2</th></tr>
<tr><th>Cell 2</th><th>Cell 3</th><th>Cell 2</th><th>Cell 3</th></tr>
<tr><td colspan="2">SSB ARFCN</td><td></td><td colspan="2">Freq1</td><td colspan="2">Freq1</td></tr>
<tr><td colspan="2">Duplex mode</td><td></td><td colspan="2">TDD</td><td colspan="2">TDD</td></tr>
<tr><td colspan="2">TDD configuration</td><td></td><td colspan="2">TDDConf.3.1</td><td colspan="2">TDDConf.3.1</td></tr>
<tr><td colspan="2">$BW_{channel}$</td><td>MHz</td><td colspan="2">100: $N_{RB,c}$ = 66</td><td colspan="2">100: $N_{RB,c}$ = 66</td></tr>
<tr><td rowspan="4">BWP configuration</td><td>Initial DL BWP</td><td rowspan="4"></td><td colspan="4">DLBWP.0.1</td></tr>
<tr><td>Dedicated DL BWP</td><td colspan="4">DLBWP.1.1</td></tr>
<tr><td>Initial UL BWP</td><td colspan="4">ULBWP.0.1</td></tr>
<tr><td>Dedicated UL BWP</td><td colspan="4">ULBWP.1.1</td></tr>
<tr><td colspan="2">TRS configuration</td><td></td><td>TRS.2.1 TDD</td><td></td><td>TRS.2.1 TDD</td><td></td></tr>
<tr><td colspan="2">TCI state</td><td></td><td>TCI.State.0</td><td></td><td>TCI.State.0</td><td></td></tr>
<tr><td colspan="2">PDSCH Reference measurement channel</td><td></td><td>SR.3.1 TDD</td><td></td><td>SR.3.1 TDD</td><td></td></tr>
<tr><td colspan="2">RMSI CORESET Reference Channel</td><td></td><td>CR.3.1 TDD</td><td>-</td><td>CR.3.1 TDD</td><td>-</td></tr>
<tr><td colspan="2">Control channel RMC</td><td></td><td>CCR.3.1 TDD</td><td>-</td><td>CCR.3.1 TDD</td><td>-</td></tr>
<tr><td colspan="2">OCNG Patterns</td><td></td><td>OP.1</td><td>OP.1</td><td>OP.1</td><td>OP.1</td></tr>
<tr><td colspan="2">SMTC configuration</td><td></td><td colspan="4">SMTC.1</td></tr>
<tr><td colspan="2">SSB configuration</td><td></td><td>SSB.1 FR2</td><td>SSB.1 FR2</td><td>SSB.1 FR2</td><td>SSB.1 FR2</td></tr>
<tr><td colspan="2">PDSCH/PDCCH subcarrier spacing</td><td>kHz</td><td>120</td><td>120</td><td>120</td><td>120</td></tr>
<tr><td colspan="2">SS-RSSI-Measurement</td><td></td><td colspan="4">Not Applicable</td></tr>
<tr><td colspan="2">EPRE ratio of PSS to SSS
EPRE ratio of PBCH_DMRS to SSS
EPRE ratio of PBCH to PBCH_DMRS
EPRE ratio of PDCCH_DMRS to SSS
EPRE ratio of PDCCH to PDCCH_DMRS
EPRE ratio of PDSCH_DMRS to SSS
EPRE ratio of PDSCH to PDSCH_DMRS
EPRE ratio of OCNG DMRS to SSS[Note 1]
EPRE ratio of OCNG to OCNG DMRS [Note 1]</td><td>dB</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td colspan="2">$\hat{E}_s/N_{oc}$</td><td>dB</td><td>3</td><td>3</td><td>-3</td><td>-3</td></tr>
<tr><td colspan="7">Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Void</td></tr>
</table>

Table A.5.7.2.1.2-3: SS-RSRQ Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1 according to clause A.3.15.1	
Assumption for UE beams[Note 9]		Rough			
N_{oc} [Note1]	dBm/15kHz[Note4]	-95		-95	
N_{oc} [Note1]	dBm/SCS[Note 3]	-86		-86	
SS-RSRP[Note2]	dBm/SCS [Note4]	-83	-83	-89	-89
SS-RSRQ [Note2]	dB	-14.77	-14.77	-16.81	-16.81
$\hat{E}_s/I_{ot}$	dB	-1.76	-1.76	-4.76	-4.76
Io[Note2]	dBm/95.04 MHz [Note4]	-50		-54	-54

Note 1:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2:	SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3:	SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4:	Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5:	As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6:	NR operating band groups are as defined in Clause 3.5.2.
Note 7:	Void
Note 8:	Void
Note 9:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.2.1.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal SS-RSRQ+2.5dB to Nominal SS-RSRQ -3.5dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal SS-RSRQ +3.5dB to Nominal SS-RSRQ -4.5dB according to the requirements in clause 10.1.8.1.1 with an additional -1dB margin reflecting the possible impact of UE self noise in the test. Nominal SS-RSRQ is the value shown in table A.5.7.2.1.2-3. The SS-RSRQ relative measurement accuracy shall meet the requirements in clause 10.1.8.1.1.

A.5.7.2.2 EN-DC Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.1.1 and 10.1.9.1.2 for inter-frequency measurement.

A.5.7.2.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.5.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test setup in Table A.5.7.2.2.2-2 and Table A.5.7.2.2.2-3. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1.

Table A.5.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.5.7.2.2.2-2: SS-RSRQ Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3

SSB ARFCN		Freq1	freq2	freq1	Freq2
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS EPRE ratio of PBCH_DMRS to SSS EPRE ratio of PBCH to PBCH_DMRS EPRE ratio of PDCCH_DMRS to SSS EPRE ratio of PDCCH to PDCCH_DMRS EPRE ratio of PDSCH_DMRS to SSS EPRE ratio of PDSCH to PDSCH_DMRS EPRE ratio of OCNG DMRS to SSS Note 1	dB	0	0	0	0
$\hat{E}_s/N_{oc}$	dB	-1.75	-1.75	-3	-3
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRQ, SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					

Table A.5.7.2.2.2-3: SS-RSRQ Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3

AoA setup		Setup 1 in clause A.3.15		Setup 1 in clause A.3.15	
Assumption for UE beams Note 8		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note4	-94.03		-94.03	
N_{oc} Note1	dBm/SCS Note 3	-85.0		-85.0	
SSB_RP Note2	dBm/SCS Note4	-86.75	-86.75	-88	-88
SS-RSRQ Note2	dB	-14.75	-14.75	-15.56	-15.56
$\hat{E}_s/I_{ot}$	dB	-1.75	-1.75	-3	-3
Io Note2	dBm/95.04 MHz Note4	-53.8	-53.8	-54.25	-54.25

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRQ, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: Void
Note 7: Void
Note 8: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.2.2.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal SS-RSRQ+2.5dB to Nominal SSRQ-3.5dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal SS-RSRQ+3.5dB to Nominal SS-RSRQ-4.5dB according to the requirements in clause 10.1.10.1.1 with an additional -1dB margin reflecting the possible impact of UE self noise in the test.

The SS-RSRQ relative measurement accuracy shall fulfil the requirements in clause 10.1.10.1.2.

A.5.7.3 SS-SINR

A.5.7.3.1 EN-DC Intra-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.13.1.1.

A.5.7.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in Table A.5.7.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is test by using the parameters in Table A.5.7.3.1.2-2 and Table A.5.7.3.1.2-3. The configuration of cell 1 (E-UTRA PCell) is specified in clause A.3.7.2.1. In all test cases, Cell 2 is the PSCell and Cell 3 is the target cell.

Table A.5.7.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Configuration	Description
1	FDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	TDD LTE PCell, Cell 2&3 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations	

Table A.5.7.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
SSB ARFCN		Freq2		Freq2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1			
Downlink dedicated BWP configuration		DLBWP.1.1			
Uplink initial BWP configuration		ULBWP.0.1			
Uplink dedicated BWP configuration		ULBWP.1.1			
DRX cycle configuration	ms	Not applicable			
TRS configuration		TRS.2.1 TDD			
TCI state		TCI.State.0			
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated RMSI CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1			
SSB configuration		SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
SS-RSSI-Measurement		Not Applicable			
EPRE ratio of PSS to SSS EPRE ratio of PBCH_DMRS to SSS EPRE ratio of PBCH to PBCH_DMRS EPRE ratio of PDCCH_DMRS to SSS EPRE ratio of PDCCH to PDCCH_DMRS EPRE ratio of PDSCH_DMRS to SSS EPRE ratio of PDSCH to PDSCH_DMRS EPRE ratio of OCNG DMRS to SSS Note 1 EPRE ratio of OCNG to OCNG DMRS Note 1	dB	0	0	0	0
$\hat{E}_s/N_{oc}$	dB	4.54	2.66	-3	-3
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					

Table A.5.7.3.1.2-3: SS-SINR Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 2	Cell 3	Cell 2	Cell 3
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note4	-105		N/A	
N_{oc} Note1	dBm/SCS Note3	-96		N/A	
SS-RSRP Note2	dBm/SCS Note4	-91.46	-93.34	-99	-99
SS-SINR Note2	dB	0	-3.2	-4.76	-4.76
$\hat{E}_s/I_{ot}$	dB	0	-3.2	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-59.2		-64	

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: NR operating band groups are as defined in Clause 3.5.2.
Note 7: Void
Note 8: Void
Note 9: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.3.1.3 Test Requirements

clauseThe SS-SINR absolute measurement accuracy in test 1 shall be within the range Nominal SS-SINR+3B to Nominal SS-SINR -4dB and the SS-SINR measurement accuracy in test 2 shall be within the range Nominal SS-SINR +3.5dB to Nominal SS-SINR -4.5dB according to the requirements in clause 10.1.10.13.1 with an additional -1dB margin reflecting the possible impact of UE self noise in the test. Nominal SS-SINR is the value shown in table A.5.7.3.1.2-3.

The SS-SINR relative measurement accuracy shall fulfil the requirements in clause 10.1.13.1.1.

A.5.7.3.2 EN-DC Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.5.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.15.1.1 and 10.1.15.1.2 for inter-frequency measurement.

A.5.7.3.2.2 Test Parameters

In this test case the two NR cells (i.e., Cell 2 and Cell 3) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.5.7.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test setup in Table A.5.7.3.2.2-2 and Table A.5.7.3.2.2-3. In all test cases, Cell 2 is the PSCell and Cell 3 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1. The TCI status for Cell 1 is defined in Table A.3.16.2-1 and TRS configuration for Cell 1 is defined in Table A.3.17.2.1-1.

Table A.5.7.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.5.7.3.2.2-2: SS-SINR Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3

SSB ARFCN		Freq1	freq2	freq1	Freq2	freq1	Freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1					
Downlink dedicated BWP configuration		DLBWP.1.1					
Uplink initial BWP configuration		ULBWP.0.1					
Uplink dedicated BWP configuration		ULBWP.1.1					
DRX cycle configuration	ms	Not applicable					
TRS configuration		TRS.2.1 TDD					
TCI state		TCI.State.0					
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC. 1 FR2	SMTC. 1 FR2	SMTC. 1 FR2	SMTC. 1 FR2	SMTC. 1 FR2	SMTC. 1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120	120	120
EPRE ratio of PSS to SSS EPRE ratio of PBCH_DMRS to SSS EPRE ratio of PBCH to PBCH_DMRS EPRE ratio of PDCCH_DMRS to SSS EPRE ratio of PDCCH to PDCCH_DMRS EPRE ratio of PDSCH_DMRS to SSS EPRE ratio of PDSCH to PDSCH_DMRS EPRE ratio of OCNG DMRS to SSS[Note 1]	dB	0	0	0	0	0	0
$\hat{E}_s/N_{oc}$	dB	-0.5	-0.5	11.0	11.0	-3.0	-3.0
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-SINR, SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.							

Table A.5.7.3.2.2-3: SS-SINR Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 2	Cell 3	Cell 2	Cell 3	Cell 2	Cell 3

Angle of arrival configuration	degrees	Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams[Note 10]		Rough		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note4	-105		-105		-105	
N_{oc} Note1	dBm/SCS Note3	-96		-96		-96	
SS-RSRP[Note2]	dBm/SCS Note4	-96.5	-96.5	-85	-85	-99	-99
SS-SINR[Note2]	dB	-0.5	-0.5	11	11	-3.0	-3.0
$\hat{E}_s/I_{ot}$	dB	-0.5	-0.5	11	11	-3.0	-3.0
Io[Note2]	dBm/95.04 MHz Note4	-69.3		-55.4		-65.24	

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: NR operating band groups are as defined in Clause 3.5.2.
Note 7: Void
Note 8: Void
Note 9: Void
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.5.7.3.2.3 Test Requirements

The SS-SINR absolute measurement accuracy in test 1 shall be within the range Nominal SS-SINR+3dB to Nominal SS-SINR -4dB and the SS-SINR measurement accuracy in test 2 shall be within the range Nominal SS-SINR+3.5dB to Nominal SS-SINR -4.5dB according to the requirements in clause 10.1.15.1.1 with an additional -1dB margin reflecting the possible impact of UE self noise in the test. Nominal SS-SINR is the value shown in table A.5.7.2.2.2-3

The SS-SINR relative measurement accuracy shall fulfil the requirements in clause 10.1.15.1.2.

A.5.7.4 L1-RSRP measurement for beam reporting

A.5.7.4.1 SSB based L1-RSRP measurement

A.5.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 9.5.2 and clause 10.1.20.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in Table A.5.7.4.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.5.7.4.1.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.4.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.7.4.1.2-1 and Table A.5.7.4.1.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.5.7.4.1.2-1 and Table A.5.7.4.1.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.5.7.4.1.2-1: FR2 SSB based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1~4		freq1	freq1
Duplex mode	1~4		TDD	TDD
TDD Configuration	1~4		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1~4	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~4		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1~4		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1~4		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1,2		SSB.1 FR2	SSB.1 FR2
	3,4		SSB.2 FR2	SSB.2 FR2
OCNG Patterns	1~4		OP.1	OP.1
Initial BWP Configuration	1~4		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~4		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
TRS Configuration	1~4		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~4		TCI.State.2	TCI.State.2
SMTC configuration	1~4		SMTC.1	SMTC.1
reportConfigType	1~4		periodic	periodic
reportQuantity	1~4		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~4		2	2
L1-RSRP reporting period	1~4		slot640	slot640
Propagation condition	1~4		AWGN	AWGN
Antenna configuration			1x2	1x2
EPRE ratio of PSS to SSS	1~4	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

Table A.5.7.4.1.2-2: FR2 SSB based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			SSB0	SSB1	SSB0	SSB1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough		Rough	
N_{oc}	1~4	dBm/15 kHz	-100		n.a.	
N_{oc}	1,2	dBm/SSB SCS	-91		n.a.	
	3,4		-88		n.a.	
$\hat{E}_s/I_{ot}$	1~4	dB	10	-2	n.a.	
SS-RSRP Note1	1,2	dBm/SCS	-81	-93	As in Table B.2.4-2	
	3,4		-78	-90	As in Table B.2.4-2	
Io Note1	1~4	dBm/ 95.04MHz	-51.57		SS-RSRP+28.98	
$\hat{E}_s/N_{oc}$	1~4	dB	10	-2	n.a.	
Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 3: No additional noise is added by the test system in Test 2. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.5.7.4.1.3 Test Requirements

After 640ms from the beginning of the test, the L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in clauses 10.1.20.1. The following requirements are to be verified:

For Test 1:

Absolute accuracy of SSB0 and absolute accuracy of SSB1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.5.7.4.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.1.2-1.

For Test 2:

Absolute accuracy of SSB0 and absolute accuracy of SSB1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.5.7.4.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.1.2-1.

Table A.5.7.4.1.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SSB0	SSB_RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP0 +δ + G_{max}
SSB1	SSB_RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP1 +δ + G_{max}
Note 1: SSB_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the SSB n under consideration Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.1.1-1, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.7.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.5.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 9.5.3 and clause 10.1.20.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in Table A.5.7.4.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.5.7.4.2.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.4.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR1 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.7.4.2.2-1 and Table A.5.7.4.2.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.5.7.4.2.2-1 and Table A.5.7.4.2.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.5.7.4.2.2-1: FR2 CSI-RS based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1~2		freq1	freq1
Duplex mode	1~2		TDD	TDD
TDD Configuration	1~2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1~2		SSB.1 FR2	SSB.1 FR2
OCNG Patterns	1~2		OP.1	OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
TRS Configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2	TCI.State.2
SMTC configuration	1~2		SMTC.1	SMTC.1
CSI-RS	1~2		CSI-RS.3.2 TDD	CSI-RS.3.2 TDD
reportConfigType	1~2		periodic	periodic
reportQuantity	1~2		cri-RSRP	cri-RSRP
Number of reported RS	1~2		2	2
L1-RSRP reporting period	1~2		slot640	slot640
Propagation condition	1~2		AWGN	AWGN
Antenna configutaion	1~2		1x2	1x2
EPRE ratio of PSS to SSS	1~2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

Table A.5.7.4.2.2-2: FR2 CSI-RS based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			CSI-RS0	CSI-RS1	CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough		Rough	
N_{oc}	1~2	dBm/15 kHz	-100		n.a.	
N_{oc}	1~2	dBm/SSB SCS	-91		n.a. n.a.	
$\hat{E}_s/I_{ot}$	1~2	dB	10	-2	n.a.	
CSI-RS-RSRP Note1	1~2	dBm/SCS	-81	-93	As in Table B.2.4-2	
Io Note1	1~2	dBm/ 95.04MHz	-59.86		SS-RSRP+28.98	
$\hat{E}_s/N_{oc}$	1~2	dB	-51.57	-2	n.a.	
Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 3: No additional noise is added by the test system in Test 2. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.5.7.4.2.3 Test Requirements

After 640ms from the beginning of the test, the L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 2 shall fulfil the requirements in clauses 10.1.20.2. The following requirements are to be verified:

For Test 1:

Absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.5.7.4.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.2.2-1.

For Test 2:

Absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.5.7.4.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.2.2-1.

Table A.5.7.4.2.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}
Note 1: CSI-RS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.7.5 CLI measurements

A.5.7.5.1 EN-DC SRS-RSRP measurement accuracy with FR2 serving cell

A.5.7.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.22.1.1 with the testing configurations for NR cells in Table A.5.7.5.1.1-1.

Table A.5.7.5.1.1-1: Applicable NR configurations for FR2 SRS-RSRP accuracy test

Config	Description
1	LTE FDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.5.1.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.7.5.1.2-1 and A.5.7.5.1.2-2 below. The test parameter for the (virtual) neighbor cell UE transmitting SRS are given in Table A.5.7.5.1.2-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in Table A.5.7.5.1.2-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

Table A.5.7.5.1.2-1: FR2 test parameters for SRS-RSRP accuracy

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1~2		freq1	freq1
Duplex mode	1~2		TDD	TDD
TDD configuration	1~2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1~2		SSB.3 FR2	SSB.3 FR2
OCNG Patterns	1~2		OP.1	OP.1
TRS configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1	SMTC.1
Time offset between DL from serving cell and SRS from test system	1~2	μs	10.76	10.67
EPRE ratio of PSS to SSS EPRE ratio of PBCH DMRS to SSS EPRE ratio of PBCH to PBCH DMRS EPRE ratio of PDCCH DMRS to SSS EPRE ratio of PDCCH to PDCCH DMRS EPRE ratio of PDSCH DMRS to SSS EPRE ratio of PDSCH to PDSCH DMRS EPRE ratio of OCNG DMRS to SSS Note 1 EPRE ratio of OCNG to OCNG DMRS Note 1	1~2	dB	0	0
Propagation condition	1~2		AWGN	AWGN
Antenna configuration	1~2		1x2	1x2
SRS configuration	1~2		SRSConf.1	SRSConf.1
Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.5.7.5.1.2-2: SRS-RSRP accuracy OTA related test parameters for PSCell and Neighbour cell UE in FR2

Parameter	Unit	T1	T2
Angle of arrival configuration		Setup 1 defined A.3.15.1	Setup 1 defined A.3.15.1
Beam assumption Note 5		Fine	Fine
N_{oc} Note1	dBm/15kHz Note3	-100	N/A
N_{oc} Note1	dBm/SCS Note3	-91	N/A
$\hat{E}_s/N_{oc}$	dB	2	N/A
E_s	dBm/SCS Note3		(Table B.2.7-2 Rx Beam Peak)
SRS_RP Note2	dBm/SCS	-89	(Table B.2.7-2 Rx Beam Peak)
$\hat{E}_s/I_{ot\ BB}$ Note4	dB	>1	1
Io Note2	dBm/95.04 MHz Note3	-57.89	(Table B.2.7-2 Rx Beam Peak +50.79dB)
Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2dB for UE multi-band relaxation factor $\sum MB_P$ from TS 38.101-2 [19] Table 6.2.1.3-4. Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.			

Table A.5.7.5.1.2-3: SRS configuration parameters for FR2 SRS-RSRP accuracy

	Field	SRSConf.1
SRS-ResourceSet	srs-ResourceSetId	0
	srs-ResourceIdList	0
	resourceType	Periodic
	Usage	Codebook
SRS-Resource	SRS-ResourceId	0
	nrofSRS-Ports	Port1
	transmissionComb	n2
	combOffset-n2	0
	cyclicShift-n2	0
	resourceMapping startPosition	0
	resourceMapping nrofSymbols	n1
	resourceMapping repetitionFactor	n1
	freqDomainPosition	0
	freqDomainShift	0
	freqHopping c-SRS	12
	freqHopping b-SRS	0
	freqHopping b-hop	0
	groupOrSequenceHopping	Neither
	resourceType	Periodic
	periodicityAndOffset-p	sl160,25
	sequenceId	0

A.5.7.5.1.3 Test Requirements

The SRS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.22.1.1. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table A.5.7.5.1.3-1.

During T2:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table A.5.7.5.1.3-1.

Table A.5.7.5.1.3-1: SRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SRS	SRS_RP -δ +G_{min} ≤ Reported SRS-RSRP(dBm) ≤SRS_RP +δ +G_{max}
Note 1: SRS_RP is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.7.5.2 EN-DC CLI-RSSI measurement accuracy with FR2 serving cell

A.5.7.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CLI-RSSI measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.22.2.1 with the testing configurations for NR cells in Table A.5.7.5.2.1-1.

Table A.5.7.5.2.1-1: Applicable NR configurations for FR2 CLI-RSSI accuracy test

Config	Description
1	LTE FDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.5.7.5.2.2 Test parameters

In this set of test cases there are two cells in the test, E-UTRAN PCell (Cell 1), FR2 PSCell (Cell 2). The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 2 are given in Table A.5.7.5.2.2-1 and A.5.7.5.2.2-2 below.

Before the test UE is configured to perform CLI-RSSI measurement. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI resource and on 2 data symbol before. The CLI-RSSI measurement resource configuration is in Table A.5.7.5.2.2-3.

Table A.5.7.5.2.2-1: FR2 test parameters for CLI-RSSI accuracy

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1~2		freq1	freq1
Duplex mode	1~2		TDD	TDD
TDD configuration	1~2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1~2		SSB.3 FR2	SSB.3 FR2
OCNG Patterns Note2	1~2		OP.1	OP.1
TRS configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1	SMTC.1
Time offset between DL from serving cell and OCNG from test system	1~2	µs	10.67	10.67
EPRE ratio of PSS to SSS	1~2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1~2		AWGN	AWGN
Antenna configuration	1~2		1x2	1x2
Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.5.7.5.2.2-2: CLI-RSSI accuracy OTA related test parameters

Parameter	Unit	T1	T2
Angle of arrival configuration		Setup 1 defined A.3.15.1	
Beam assumption Note 5		Fine	
N_{oc} on CLI-RSSI measurement resource Note1	dBm/15kHz Note3	-100	
N_{oc} on CLI-RSSI measurement resource Note1	dBm/SCS Note3	-91	
$\hat{E}_s/N_{oc}$ on CLI-RSSI measurement resource	dB	-Infinity	
RSRP on CLI-RSSI measurement resource Note2	dBm/SCS	-Infinity	
$\hat{E}_s/I_{ot\ BB}$ on CLI-RSSI measurement resource Note4	dB	-Infinity	
Io on CLI-RSSI measurement resource Note2	dBm/95.04 MHz Note3	-62.01	
Io on CLI-RSSI measurement resource Note2	dBm/1.08 MHz	-81.46	

Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2dB for UE multi-band relaxation factor ΣMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

Table A.5.7.5.2.2-3: CLI-RSSI measurement resource configuration for FR2 CLI-RSSI accuracy

	Field	SRSConf.1
CLI-RSSI measurement resource	rssi-ResourceId	0
	rssi-SCS	120kHz
	startPRB	0
	nrofPRBs	66
	startPosition	3
	nrofSymbols	11
	rssi-PeriodicityAndOffset	sl160, 25

A.5.7.5.2.3 Test Requirements

The CLI-RSSI measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.22.2.1. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table A.5.7.5.2.3-1.

During T2:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table A.5.7.5.2.3-1..

Table A.5.7.5.2.3-1: CLI-RSSI absolute accuracy test requirement

	Test requirement Notes1,2,3
	Io -δ +G_{min} ≤ Reported CLI-RSSI(dBm) ≤Io +δ +G_{max}
Note 1: Io is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for 1.08MHz Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.5.8 Void

A.6 NR standalone tests with all NR cells in FR1

A.6.1 SA: RRC_IDLE state mobility

A.6.1.1 Cell re-selection to NR

A.6.1.1.1 Cell reselection to FR1 intra-frequency NR case

A.6.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements specified in clause 4.2.2.3.

A.6.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.1.1.1.2-1, A.6.1.1.1.2-2 and A.6.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only cell 1 is already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2.

Table A.6.1.1.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.1.1.1.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell1	
T2 end condition	Active cell		1, 2, 3	Cell2	
	Neighbour cells		1, 2, 3	Cell1	
Final condition	Active cell		1, 2, 3	Cell1	
	Neighbour cells		1, 2, 3	Cell2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	1, 2, 3	40	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	1, 2, 3	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-130			-130		
		3	-127			-127		
Pcompensation	dB	1, 2, 3	0			0		
$Qhyst_s$	dB	1, 2, 3	0			0		
$Qoffset_{s,n}$	dB	1, 2, 3	0			0		
Cell_selection_and_reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	1	16	-3.11	2.79	-infinity	2.79	-3.11
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	16	13	16	-infinity	16	13
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-82	-85	-82	-infinity	-82	-85
		2	-82	-85	-82	-infinity	-82	-85
		3	-79	-82	-79	-infinity	-79	-82
Io	dBm/9.36 MHz	1	-53.94	-52.21	-52.21	Same as parameters specified in Cell 1 columns-		
	dBm/9.36 MHz	2	-53.94	-52.21	-52.21			
	dBm/38.16 MHz	3	-47.85	-46.12	-46.12			
Treselection	s	1, 2, 3	0	0	0	0	0	0
SintrasearchP	dB	1, 2, 3	60			60		
Propagation Condition		1, 2, 3	AWGN					

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.1.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 34 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on cell 1.

The cell re-selection delay to an already detected cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: T_{detect, NR_Intra} + T_{SI-NR}, and to an already detected cell can be expressed as: $T_{evaluate, NR\_ intra}$ + T_{SI-NR},

Where:

T_{detect, NR_Intra} See Table 4.2.2.3-1 in clause 4.2.2.3

$T_{evaluate, NR\_ intra}$ See Table 4.2.2.3-1 in clause 4.2.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280ms is assumed in this test case.

This gives a total of 33.28 s, allow 34 s for the cell re-selection delay to a newly detectable cell and 7.68 s for the cell re-selection delay to an already detected cell in the test case, which we allow 8 s.

A.6.1.1.2 Cell reselection to FR1 inter-frequency NR case

A.6.1.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2.2.4.

A.6.1.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.6.1.1.2.2-1, A.6.1.1.2.2-2 and A.6.1.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and cell 2 is of higher priority than cell 1.

Table A.6.1.1.2.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.1.2.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell2	The UE camps on cell 2 in the initial phase and during T1 period the UE reselects to cell 1
	Neighbour cell		1, 2, 3	Cell 1	
T1 end condition	Active cell		1, 2, 3	Cell1	The UE shall perform reselection to cell 1 during T1
	Neighbour cells		1, 2, 3	Cell2	
T3 end condition	Active cell		1, 2, 3	Cell2	The UE shall perform reselection to cell 2 with higher priority during T3
	Neighbour cell		1, 2, 3	Cell 1	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC.2	
			2	SMTC.1	
			3	SMTC.1	
DRX cycle length		s	1, 2, 3	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	>7	During T2, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2, 3	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.2.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-140			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3	0			0		
Cell_selection_and_reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	14	14	14	-4	-infinity	12
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-84	-84	-84	-102	-infinity	-86
		2	-84	-84	-84	-102	-infinity	-86
		3	-81	-81	-81	-99	-infinity	-83
Io	dBm/9.36 MHz	1	-55.88	-55.88	-55.88	-68.60	-infinity	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-55.88	-68.60	-infinity	-57.78
	dBm/38.16 MHz	3	-49.79	-49.79	-49.79	-62.50	-infinity	-51.69
Treselection	s	1, 2, 3	0	0	0	0	0	0
SnonintrasearchP	dB	1, 2, 3	50			50		
$Thresh_{x, highP}$	dB	1, 2, 3	48			48		
$Thresh_{serving, lowP}$	dB	1, 2, 3	44			44		
$Thresh_{x, lowP}$	dB	1, 2, 3	50			50		
Propagation Condition		1, 2, 3	AWGN					

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.1.1.2.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps again on cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on cell 1.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher\_priority\_search}$ + $T_{evaluate, NR\_ inter}$ + T_{SI-NR}, and to a lower priority cell can be expressed as: $T_{evaluate, NR\_ inter}$ + T_{SI-NR},

Where:

$T_{higher\_priority\_search}$ See clause 4.2.2.7

$T_{evaluate, NR\_ inter}$ See Table 4.2.2.4-1 in clause 4.2.2.4

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority cell and 7.68 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.6.1.1.3 Cell reselection to FR1 intra-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.6.1.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for UE fulfilling low mobility criterion specified in clause 4.2.2.9.2

A.6.1.1.3.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.1.1.3.2-1, A.6.1.1.3.2-2 and A.6.1.1.3.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2.

Table A.6.1.1.3.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.1.1.3.2-2: General test parameters for FR1 intra frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Value	Comment

Initial condition	Active cell		1, 2, 3	Cell1	The UE camps on cell 1 in the initial phase
	Neighbour cells		1, 2, 3	Cell2	
T1 end condition	Active cell		1, 2, 3	Cell2	The UE reselects to cell 2 during T1 period
	Neighbour cells		1, 2, 3	Cell1	
Final condition	Active cell		1, 2, 3	Cell1	The UE reselects to cell 1 during T2 period
	Neighbour cells		1, 2, 3	Cell2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	20	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	20	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.3.2-3: Cell specific test parameters for FR1 intra frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s, n}$	dB	1, 2, 3	0		0	
$S_{SearchDeltaP}$	dB	1, 2, 3	3		3	
Cell_selection_and_reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s / I_{ot}$	dB	1, 2, 3	-3.11	2.79	2.79	-3.11
N_{oc} Note2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1, 2, 3	-98			
$\hat{E}_s / N_{oc}$	dB	1, 2, 3	13	16	16	13
SS-RSRP Note3	dBm/SCS	1	-85	-82	-82	-85
		2	-85	-82	-82	-85
		3	-82	-79	-79	-82
Io	dBm/9.36 MHz	1	-52.21	-52.21	specified in Cell 1 columns-	
	dBm/9.36 MHz	2	-52.21	-52.21		
	dBm/38.16 MHz	3	-46.12	-46.12		
Treselection	s	1, 2, 3	0	0	0	0
SintrasearchP	dB	1, 2, 3	60		60	

Propagation Condition		1, 2, 3	AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

A.6.1.1.3.3 Test Requirements

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected cell shall be less than 17 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on cell 1.

The cell re-selection delay to an already detected cell shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to an already detected cell can be expressed as: $T_{evaluate,NR\_Intra}$ + T_{SI-NR},

Where:

$T_{evaluate,NR\_Intra}$ See Table 4.2.2.9.2-1 in clause 4.2.2.9.2 for reselection to Cell 2 during T1 with UE fulfilling low mobility criterion. 15.36s.

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s, allow 17 s for the cell re-selection delay to an already detected cell for UE fulfilling low mobility criterion in the test case.

A.6.1.1.4 Cell reselection to FR1 intra-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.6.1.1.4.1 Test Purpose and Environment

This test is to verify the relaxed cell re-selection requirement for UEs configured with not-at-cell edge criterion specified in clause 4.2.2.9.3.

A.6.1.1.4.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.1.1.4.2-1, A.6.1.1.4.2-2 and A.6.1.1.4.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both Cell 1 and Cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas.

Table A.6.1.1.4.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.1.1.4.2-2: General test parameters for FR1 intra frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active Cell		1, 2, 3	Cell1	The UE camps on Cell 1 in the initial phase
	Neighbour Cells		1, 2, 3	Cell2	
T1 end condition	Active Cell		1, 2, 3	Cell2	The UE shall fulfil the not-at-cell edge criterion and reselect to cell 2 during T1 period during T1.
	Neighbour Cells		1, 2, 3	Cell1	
T2 end condition	Active Cell		1, 2, 3	Cell1	The UE shall perform reselection to Cell 1 during T2
	Neighbour Cells		1, 2, 3	Cell2	
RF Channel Number			1, 2, 3	1	
Time offset between Cells			1	3 ms	Asynchronous Cells
			2	3 μs	Synchronous Cells
			3	3 μs	Synchronous Cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all Cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	17	T1 needs to be defined so that Cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	17	T2 needs to be defined so that Cell re-selection reaction time is taken into account.

Table A.6.1.1.4.2-3: Cell specific test parameters for FR1 intra frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s/I_{ot}$	dB	1	-3.11	2.79	2.79	-3.11
		2				
		3				
N_{oc} Note2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	13	16	16	13
		2				
		3				
SS-RSRP Note3	dBm/SCS	1	-85	-82	-82	-85
		2	-85	-82	-82	-85
		3	-82	-79	-79	-82
Io	dBm/9.36 MHz	1	-52.21	-52.21	-52.21	-52.21
	dBm/9.36 MHz	2	-52.21	-52.21	-52.21	-52.21
	dBm/38.16 MHz	3	-46.12	-46.12	-46.12	-46.12
Treselection	s	1, 2, 3	0	0	0	0
Sintrasearch	dB	1, 2, 3	60		60	
$S_{searchDeltaP}$	dB	1, 2, 3	Not sent	Not sent	Not sent	Not sent
$S_{searchThresholdP}$	dB	1, 2, 3	50	Not sent	Not sent	50
Propagation Condition		1, 2, 3	AWGN			

Note 1:	OCNG shall be used such that both Cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other Cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.1.1.4.3 Test Requirements

The cell re-selection delay to an already detected cell for UE configured with *cellEdgeEvaluation* criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected cell for UE configured with *cellEdgeEvaluation* criterion shall be less than 17s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to an already detected cell for UE configured with relaxed measurement criterion can be expressed as: $T_{evaluate,NR\_Intra} + T_{SI-NR}$,

Where:

$T_{evaluate,NR\_Intra}$ See Table 4.2.2.9.3-1 for UE fulfilling not-at-cell edge criterion in clause 4.2.2.9.3.

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a Cell; 1280ms is assumed in this test case.

This gives a total of 16.64s, allow 17s for the cell re-selection delay to an already detected cell for UE fulfilling not-at-cell edge criterion in the test case.

A.6.1.1.5 Cell reselection to FR1 inter-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.6.1.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2.2.10.2, for UE fulfilling low mobility relaxed measurement criterion.

A.6.1.1.5.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.6.1.1.5.2-1, A.6.1.1.5.2-2 and A.6.1.1.5.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and cell 2 is of higher priority than cell 1.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1]. So, Cell 2 and Cell 1 configure the UE as follows:

lowMobilityEvalutation [2] criterion is configured according to the parameters listed in Table A.6.1.1.5.2-3;

cellEdgeEvaluation [2] criterion is not configured;

combineRelaxedMeasCondition [2] is not configured;

Table A.6.1.1.5.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.1.5.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell2	The UE camps on cell 2 in the initial phase, it fulfills Low Mobility relaxation measurements criterion, and during T1 period the UE reselects to cell 1
T1 end condition	Active cell		1, 2, 3	Cell1	The UE shall perform reselection to cell 1 during T1
	Neighbour cells		1, 2, 3	Cell2	
T2 end condition	Active cell		1, 2, 3	Cell2	The UE shall perform reselection to cell 2 with higher priority during T2
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB Configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	20 s	T1 is defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	20 s	T2 is defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.5.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		SR.1.1 FDD	
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s/I_{ot}$	dB	1	14	14	-4	12
		2				
		3				
N_{oc} Note2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	14	14	-4	12
		2				
		3				
SS-RSRP Note3	dBm/SCS	1	-84	-84	-102	-86
		2	-84	-84	-102	-86
		3	-81	-81	-99	-83
Io	dBm/9.36 MHz	1	-55.88	-55.88	-68.60	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-68.60	-57.78
	dBm/38.16 MHz	3	-49.79	-49.79	-62.50	-51.69
Treselection	s	1, 2, 3	0	0	0	0

SnonintrasearchP	dB	1, 2, 3	Not sent	Not sent
$Thresh_{x, high}$	dB	1, 2, 3	48	48
$Thresh_{serving, low}$	dB	1, 2, 3	44	44
$Thresh_{x, low}$	dB	1, 2, 3	50	50
$S_{SearchDeltaP}$	dB	1, 2, 3	3	3
$T_{SearchDeltaP}$	s	1, 2, 3	5	5
Propagation Condition		1, 2, 3	AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.1.1.5.3 Test Requirements

The cell reselection delay to an already detected lower priority cell for UE fulfilling low mobility relaxed measurements is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on cell 1.

The cell re-selection delay to a lower priority cell for UE fulfilling low mobility relaxed measurements shall be less than 17 s.

The cell reselection delay to an already detected higher priority cell for UE fulfilling low mobility relaxed measurements is defined as the time from the beginning of time period T2, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the RRCSetupRequest message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling low mobility relaxed measurements shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a known lower priority cell can be expressed as: $T_{evaluate, NR\_ inter} + T_{SI-NR}$,

Where:

$T_{evaluate, NR\_ inter}$ See Table 4.2.2.10.2-1 in clause 4.2.2.10.2

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s, allow 17s for the cell re-selection delay to an already detected lower priority cell and 16.64s for the cell re-selection delay to an already detected higher priority cell, which we allow 17s for UE fulfilling low mobility relaxed measurements in the test case.

A.6.1.1.6 Cell reselection to FR1 inter-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.6.1.1.6.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2.2.10.3, for UE fulfilling not-at-cell edge relaxed measurement criterion.

A.6.1.1.6.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.6.1.1.6.2-1, A.6.1.1.6.2-2 and A.6.1.1.6.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and cell 2 is of higher priority than cell 1.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for UE not-at-cell edge as defined in clause 5.2.4.9.2 in [1]. So, Cell 2 and Cell 1configures the UE as follows:

cellEdgeEvaluation [2] criterion is configured according to the parameters listed in Table A.6.1.1.5.2-3;

lowMobilityEvalutation [2] criterion is not configured;

combineRelaxedMeasCondition [2] is not configured;

Table A.6.1.1.6.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.1.6.2-2: General test parameters for FR1 inter frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell2	The UE camps on cell 2 in the initial phase, it fulfills Not-at-cell edge relaxation measurements criterion, and during T1 period the UE reselects to cell 1
T1 end condition	Active cell		1, 2, 3	Cell1	The UE shall perform reselection to cell 1 during T1
	Neighbour cells		1, 2, 3	Cell2	

T2 end condition	Active cell		1, 2, 3	Cell2	The UE shall perform reselection to cell 2 with higher priority during T2
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 µs	Synchronous cells
			3	3 µs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	20 s	T1 is defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3	20 s	T2 is defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.6.2-3: Cell specific test parameters for FR1 inter frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		SR.1.1 FDD	
		2	SR.1.1 TDD		SR.1.1 TDD	
		3	SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2, 3	SSB		SSB	
Qrxlevmin	dBm/SCS	1, 2	-140		-140	
		3	-137		-137	
Pcompensation	dB	1, 2, 3	0		0	
$Qhyst_s$	dB	1, 2, 3	0		0	
$Qoffset_{s,n}$	dB	1, 2, 3	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2, 3	SS-RSRP		SS-RSRP	
$\hat{E}_s/I_{ot}$	dB	1	14	14	-4	12
		2				
		3				
N_{oc} Note2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	14	14	-4	12
		2				
		3				
SS-RSRP Note3	dBm/SCS	1	-84	-84	-102	-86
		2	-84	-84	-102	-86
		3	-81	-81	-99	-83
Io	dBm/9.36 MHz	1	-55.88	-55.88	-68.60	-57.78
	dBm/9.36 MHz	2	-55.88	-55.88	-68.60	-57.78
	dBm/38.16 MHz	3	-49.79	-49.79	-62.50	-51.69
Treselection	s	1, 2, 3	0	0	0	0

Snonintrasearch	dB	1, 2, 3	Not sent	Not sent
$Thresh_{x, high}$	dB	1, 2, 3	48	48
$Thresh_{serving, low}$	dB	1, 2, 3	44	44
$Thresh_{x, low}$	dB	1, 2, 3	50	50
$S_{SearchThresholdP}$	dB	1, 2, 3	50	50
$S_{SearchThresholdQ}$	s	1, 2, 3	Not Configured	
Propagation Condition		1, 2, 3	AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.1.1.6.3 Test Requirements

The cell reselection delay to an already detected lower priority cell for UE fulfilling not-at-cell edge relaxed measurements is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on cell 1.

The cell re-selection delay to an already detected lower priority cell for UE fulfilling not-at-cell edge relaxed measurements shall be less than 17 s.

The cell reselection delay to an already detected higher priority cell for UE fulfilling not-at-cell-edge relaxed measurements is defined as the time from the beginning of time period T2, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the RRCSetupRequest message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to an already detected higher priority cell for UE fulfilling not-at-cell-edge relaxed measurements shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, NR\_ inter} + T_{SI-NR}$,

Where:

$T_{evaluate, NR\_ inter}$ See Table 4.2.2.10.3-1 in clause 4.2.2.10

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s , allow 17s for the cell re-selection delay to an already detected lower priority cell and 16.64s for the cell re-selection delay to an already higher priority cell, which we allow 17s for UE fulfilling not-at-cell edge relaxed measurements in the test case.

A.6.1.1.7 Cell reselection to FR1 intra-frequency NR case for UE configured with *highSpeedMeasFlag-r16*

A.6.1.1.7.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for UE configured with *highSpeedMeasFlag-r16* specified in clause 4.2.2.3.

A.6.1.1.7.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.6.1.1.1.x-1, A.6.1.1.1.x-2 and A.6.1.1.1.x-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only cell 1 is already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2. *highSpeedMeasFlag-r16* is broadcasted to UE.

Table A.6.1.1.7.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.1.1.7.2-2: General test parameters for intra frequency NR cell re-selection test case for UE *configured with highSpeedMeasFlag-r16*

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell1	
	Neighbour cells		1, 2, 3	Cell2	
T2 end condition	Active cell		1, 2, 3	Cell2	
	Neighbour cells		1, 2, 3	Cell1	

Final condition	Active cell		1, 2, 3	Cell1	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	0.32	The value shall be used for all cells in the test.
PRACH configuration index			1, 2, 3	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2, 3	Not configured	
T1		s	1, 2, 3	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	1, 2, 3	40	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	1, 2, 3	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.1.7.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case for UE c*onfigured with highSpeedMeasFlag-r16*

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			SR.1.1 FDD		
		2	SR.1.1 TDD			SR.1.1 TDD		
		3	SR.2.1 TDD			SR.2.1 TDD		
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
Qrxlevmin	dBm/SCS	1, 2	-140			-140		
		3	-137			-137		
Pcompensation	dB	1, 2, 3	0			0		
$Qhyst_s$	dB	1, 2, 3	0			0		
$Qoffset_{s,n}$	dB	1, 2, 3	0			0		
Cell_selection_and_reselection_quality_measurement		1, 2, 3	SS-RSRP			SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	1	16	-3.11	2.79	-infinity	2.79	-3.11
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	16	13	16	-infinity	16	13
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-82	-85	-82	-infinity	-82	-85
		2	-82	-85	-82	-infinity	-82	-85
		3	-79	-82	-79	-infinity	-79	-82
Io	dBm/9.36 MHz	1	-53.94	-52.21	-52.21	pecified in Cell 1 columns-		
	dBm/9.36 MHz	2	-53.94	-52.21	-52.21			
	dBm/38.16 MHz	3	-47.85	-46.12	-46.12			
Treselection	s	1, 2, 3	0	0	0	0	0	0
SintrasearchP	dB	1, 2, 3	N50			N50		
Propagation Condition		1, 2	AWGN			AWGN 1944Hz Note4		
Propagation Condition		3	AWGN			AWGN 3334Hz Note5		

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.
Note 5:	The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.

A.6.1.1.7.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 4 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on cell 1.

The cell re-selection delay to an already detected cell shall be less than 3 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: T_{detect, NR_Intra} + T_{SI-NR}, and to an already detected cell can be expressed as: $T_{evaluate, NR\_ intra}$ + T_{SI-NR},

Where:

T_{detect, NR_Intra} See Table 4.2.2.3-2 in clause 4.2.2.3

$T_{evaluate, NR\_ intra}$ See Table 4.2.2.3-2 in clause 4.2.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280ms is assumed in this test case.

This gives a total of 3.84s, allow 4s for the cell re-selection delay to a newly detectable cell and 2.24 s for the cell re-selection delay to an already detected cell in the test case, which we allow 3 s.

A.6.1.2 Inter-RAT E-UTRAN cell re-selection

A.6.1.2.1 Cell reselection to higher priority E-UTRAN

A.6.1.2.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements specified in clause 4.2.2.5 when the E-UTRAN cell is of higher priority.

A.6.1.2.1.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.1.2-1, A.6.1.2.1.2-2, A.6.1.2.1.2-3 and A.6.1.2.1.2-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. NR cell 1 is already identified by the UE prior to the start of the test. E-UTRAN cell 2 is of higher priority than cell 1.

Table A.6.1.2.1.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.1.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE camps on cell 1 in the initial phase and during T2 period the UE reselects to cell 2.
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell2	The UE shall perform reselection to cell 2 during T2.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell1	
T3 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE shall perform reselection to cell 1 during T3 for iteration of the tests.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell2	
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6	4	
E-UTRAN PRACH configuration index			1, 2, 3	53	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6	4	
T1		s	1, 2, 3, 4, 5, 6	>7	During T1, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T2.
T2		s	1, 2, 3, 4, 5, 6	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	1, 2, 3, 4, 5, 6	15	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.1.2-3: Cell specific test parameters for NR cell 1

Parameter	Unit	Test configuration	Cell 1		
			T1	T2	T3
TDD configuration		1, 4	N/A		
		2, 5	TDDConf.1.1		
		3, 6	TDDConf.2.1		
PDSCH parameters		1, 4	SR.1.1 FDD		
		2, 5	SR.1.1 TDD		
		3, 6	SR.2.1 TDD		
RMSI CORESET parameters		1, 4	CR.1.1 FDD		
		2, 5	CR.1.1 TDD		
		3, 6	CR.2.1 TDD		
Dedicated CORESET parameters		1, 4	CCR.1.1 FDD		
		2, 5	CCR.1.1 TDD		
		3, 6	CCR.2.1 TDD		
SSB parameters		1, 4	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.2 FR1		
NR SMTC parameters		1, 4	SMTC.2		
		2, 5	SMTC.1		
		3, 6	SMTC.1		
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1		
RLM-RS		1, 2, 3, 4, 5, 6	SSB		
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140		
		3, 6	-137		
N_{oc}	dBm/SCS	1, 4	-98		
		2, 5	-98		
		3, 6	-95		
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98		
SS-RSRP	dBm/SCS	1, 4	-84	-84	-84
		2, 5	-84	-84	-84
		3, 6	-81	-81	-81
$\hat{E}_s/I_{ot}$	dB	1, 4	14	14	14
		2, 5			
		3, 6			
$\hat{E}_s/N_{oc}$	dB	1, 4	14	14	14
		2, 5			
		3, 6			
Io	dBm/9.36 MHz	1, 4	-55.88	-55.88	-55.88
	dBm/9.36 MHz	2, 5	-55.88	-55.88	-55.88
	dBm/38.16 MHz	3, 6	-49.79	-49.79	-49.79
Treselection	S	1, 2, 3, 4, 5, 6	0		
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6	50		
$\text{Thresh}_{x,\ highP\ (Note\ 2)}$	dB	1, 2, 3, 4, 5, 6	48		
$\text{Thresh}_{serving,\ lowP}$	dB	1, 2, 3, 4, 5, 6	44		
$\text{Thresh}_{x,\ lowP}$	dB	1, 2, 3, 4, 5, 6	50		
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: This refers to the value of $\text{Thresh}_{\mathbf{x,\ high}}$ which is included in NR system information, and is a threshold for the E-UTRA target cell					

Table A.6.1.2.1.2-4: Cell specific test parameters for E-UTRA cell 2

Parameter	Unit	Cell 2		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA Note 1	dB			
OCNG_RB Note 1	dB			
Qrxlevmin	dBm	-140		
N_{oc}	dBm/15 kHz	-98		
RSRP	dBm/15 KHz	-infinity	-86	-102
$\hat{E}_s/I_{ot}$	dB	-infinity	12	-4
$\hat{E}_s/N_{oc}$	dB	-infinity	12	-4
$Treselection_{EUTRAN}$	S	0		
SnonintrasearchP	dB	Not sent		
$Thresh_{x, highP}$	dB	48		
$Thresh_{serving, lowP}$	dB	44		
$Thresh_{x, lowP}$ (Note 2)	dB	50		
Propagation Condition		AWGN		
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: This refers to the value of $Thresh_{x, Low}$ which is included in E-UTRA system information, and is a threshold for the NR target cell				

A.6.1.2.1.3 Test Requirements

The cell reselection delay to a higher priority E-UTRAN cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher\_priority\_search} + T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{higher\_priority\_search}$ See clause 4.2.2.7

$T_{evaluate, E-UTRAN}$ See Table 4.2.2.5-1 in clause 4.2.2.5

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority E-UTRAN cell.

A.6.1.2.2 Cell reselection to lower priority E-UTRAN

A.6.1.2.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements specified in clause 4.2.2.5 when the E-UTRAN cell is of lower priority.

A.6.1.2.2.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.2.2-1, A.6.1.2.2.2-2, A.6.1.2.2.2-3 and A.6.1.2.2.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR cell 1 and E-UTRAN cell 2 are already identified by the UE prior to the start of the test. E-UTRAN cell 2 is of lower priority than cell 1.

Table A.6.1.2.2.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.2.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE camps on cell 1 in the initial phase.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell2	
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell2	The UE shall perform reselection to cell 2 during T1.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE shall perform reselection to cell 1 during T2 for iteration of the tests.
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell2	
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3	534	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6		
T1		s	1, 2, 3, 4, 5, 6	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.2.2-3: Cell specific test parameters for NR cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC.2	
		2, 5	SMTC.1	
		3, 6	SMTC.1	
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98	
SS-RSRP	dBm/SCS	1, 4	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s/I_{ot}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$\hat{E}_s/N_{oc}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-51.69
Treselection	S	1, 2, 3, 4, 5, 6	0	
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6	50	
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6	48	
$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6	44	
$Thresh_{x, lowP}$ (Note 2)	dB	1, 2, 3, 4, 5, 6	50	
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell				

Table A.6.1.2.2.2-4: Cell specific test parameters for E-UTRA cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA[Note 1]	dB		
OCNG_RB[Note 1]	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-84	-84
$\hat{E}_s/I_{ot}$	dB	14	14
$\hat{E}_s/N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	S	0	
SnonintrasearchP	dB	Not sent	
$Thresh_{x,\ highP}$ (Note 2)	dB	48	
$Thresh_{serving,\ lowP}$	dB	44	
$Thresh_{x,\ lowP}$	dB	50	
Propagation Condition		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: This refers to the value of $Thresh_{x,\ high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.6.1.2.2.3 Test Requirements

The cell reselection delay to a lower priority E-UTRAN cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to a lower priority cell shall be less than 8 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate,\ E\text{-}UTRAN} + T_{SI\text{-}E\text{-}UTRA}$,

Where:

$T_{evaluate, E-UTRAN}$ See Table 4.2.2.5-1 in clause 4.2.2.5

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 7.68 s, allow 8 s for the cell re-selection delay to a lower priority E-UTRAN cell.

A.6.1.2.3 Cell reselection to lower priority E-UTRAN for UE fulfilling low mobility relaxed measurement criterion

A.6.1.2.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection when UE fulfills the low mobility criterion specified in clause 4.2.2.11.2 and the E-UTRAN cell is of lower priority.

A.6.1.2.3.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.3.2-1, A.6.1.2.3.2-2, A.6.1.2.3.2-3 and A.6.1.2.3.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR cell 1 and E-UTRAN cell 2 are already identified by the UE prior to the start of the test. E-UTRAN cell 2 is of lower priority than cell 1.

As specified in the Test Purpose, the UE is configured with the relaxed measurement criterion for UE with low mobility defined in clause 5.2.4.9.1 in [1]. So, Cell 1 configures the UE as follows:

- *lowMobilityEvalutation* [2] criterion is configured according to the parameters listed in Table A.6.1.2.3.2-3;
- *cellEdgeEvaluation* [2] criterion is not configured;
- *combineRelaxedMeasCondition* [2] is not configured

Table A.6.1.2.3.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.3.2-2: General test parameters for NR to E-UTRAN cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE camps on cell 1 in the initial phase, it fulfills Low Mobility relaxation measurements criterion, and during T1 period the UE reselects to cell 2
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell2	The UE shall perform reselection to cell 2 during T1
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE shall perform reselection to cell 1 with higher priority during T2
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell2	
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	0.64	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3	534	As specified in table 5.7.1-2 in TS 36.211 [23]
			4, 5, 6		
T1		s	1, 2, 3, 4, 5, 6	24	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	24	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.3.2-3: Cell specific test parameters for NR cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC pattern 2	
		2, 5	SMTC pattern 1	
		3, 6	SMTC pattern 1	
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98	
SS-RSRP	dBm/SCS	1, 4	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s/I_{ot}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$\hat{E}_s/N_{oc}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-51.69
Treselection	S	1, 2, 3, 4, 5, 6	0	
Snonintrasearch	dB	1, 2, 3, 4, 5, 6	50	
$\text{Thresh}_{\text{x, high (Note 2)}}$	dB	1, 2, 3, 4, 5, 6	48	
$\text{Thresh}_{\text{serving, low}}$	dB	1, 2, 3, 4, 5, 6	44	
$\text{Thresh}_{\text{x, low}}$	dB	1, 2, 3, 4, 5, 6	50	
$\text{S}_{\text{SearchDeltaP}}$	dB	1, 2, 3, 4, 5, 6	3	
$\text{T}_{\text{SearchDeltaP}}$	s	1, 2, 3, 4, 5, 6	5	
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: This refers to the value of $\text{Thresh}_{\textbf{x, high}}$ which is included in NR system information, and is a threshold for the E-UTRA target cell

Table A.6.1.2.3.2-4: Cell specific test parameters for E-UTRA cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-84	-84
$\hat{E}_s/I_{ot}$	dB	14	14
$\hat{E}_s/N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	S	0	
Snonintrasearch	dB	Not sent	
$Thresh_{x, high (Note 2)}$	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.6.1.2.3.3 Test Requirements

The cell reselection delay to a lower priority E-UTRAN cell with UE fulfilling low mobility criterion is defined as the time from the beginning of time period T2, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a registration procedure for mobility and periodic registration update on cell 2.

The cell re-selection delay to a lower priority cell shall be less than 17 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, E-UTRAN} + T_{SI-E-UTRA}$,

Where:

$T_{evaluate, E-UTRAN}$ See Table 4.2.2.11.2-1 in clause 4.2.2.11.2

$T_{SI-E-UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 15.36 ($T_{evaluate, E-UTRAN}$) + 1.28 ($T_{SI-E-UTRA}$) = 16.64 s, allow 17 s for the cell re-selection delay to a lower priority E-UTRAN cell for UE fulfilling low mobility criterion.

A.6.1.2.4 Cell reselection to lower priority E-UTRAN for UE fulfilling not-at-cell edge relaxed measurement criterion

A.6.1.2.4.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements when UE fulfills not-at-cell edge criterion specified in clause 4.2.2.11.3 when the E-UTRAN cell is of lower priority.

A.6.1.2.4.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.4.2-1, A.6.1.2.4.2-2, A.6.1.2.4.2-3 and A.6.1.2.4.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR cell 1 and E-UTRAN cell 2 are already identified by the UE prior to the start of the test. E-UTRAN cell 2 is of lower priority than cell 1.

Table A.6.1.2.4.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.4.2-2: General test parameters for NR to E-UTRAN cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE camps on cell 1 in the initial phase and fulfill the not at the cell edge criteria.
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell2	The UE shall perform reselection to cell 2 during T1.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE shall perform reselection to cell 1 during T2 for iteration of the tests.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell2	

Access Barring Information	-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length	s	1, 2, 3, 4, 5, 6	0.64	The value shall be used for all cells in the test.
NR PRACH configuration index		1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index		1, 2, 3	534	As specified in table 5.7.1-2 in TS 36.211 [23]
		4, 5, 6		
T1	s	1, 2, 3, 4, 5, 6	24	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2	s	1, 2, 3, 4, 5, 6	24	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.4.2-3: Cell specific test parameters for NR cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC pattern 2	
		2, 5	SMTC pattern 1	
		3, 6	SMTC pattern 1	
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98	
SS-RSRP	dBm/SCS	1, 4	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s/I_{ot}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$\hat{E}_s/N_{oc}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$S_{SearchThresholdP}$	dB	1, 2, 4, 5	32	48
		3, 6	32	48

Io	dBm/9.36 MHz	1, 4	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-51.69
Treselection	S	1, 2, 3, 4, 5, 6	0	
Snonintrasearch	dB	1, 2, 3, 4, 5, 6	60	
$Thresh_{x, high}$ (Note 2)	dB	1, 2, 3, 4, 5, 6	48	
$Thresh_{serving, low}$	dB	1, 2, 3, 4, 5, 6	44	
$Thresh_{x, low}$	dB	1, 2, 3, 4, 5, 6	50	
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: This refers to the value of $Thresh_{x, high}$ which is included in NR system information, and is a threshold for the E-UTRA target cell				

Table A.6.1.2.4.2-4: Cell specific test parameters for E-UTRA cell 2

Parameter	Unit	Cell 2	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-84	-84
$\hat{E}_s/I_{ot}$	dB	14	14
$\hat{E}_s/N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	S	0	
Snonintrasearch	dB	Not sent	
$Thresh_{x, high}$ (Note 2)	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.6.1.2.4.3 Test Requirements

The cell reselection delay to a lower priority E-UTRAN cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to a lower priority cell shall be less than 17s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate,\ E\text{-}UTRAN} + T_{SI\text{-}E\text{-}UTRA}$,

Where:

$T_{evaluate,\ E\text{-}UTRAN}$ See Table 4.2.2.5-1 in clause 4.2.2.11.3

$T_{SI\text{-}E\text{-}UTRA}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 16.64 s, allow 17 s for the cell re-selection delay to a lower priority E-UTRAN cell for UE fulfilling not-at-cell edge criterion.

A.6.1.2.5 Cell reselection to lower priority E-UTRAN cell for UE configured with highSpeedMeasFlag-r16

A.6.1.2.5.1 Test Purpose and Environment

This test is to verify the requirement for the NR to E-UTRAN inter-RAT cell reselection requirements specified in clause 4.2.2.5 when the E-UTRAN cell is of lower priority.

A.6.1.2.5.2 Test Parameters

The test scenario comprises of one NR cell and one E-UTRAN cell as given in tables A.6.1.2.5.2-1, A.6.1.2.5.2-2, A.6.1.2.5.2-3 and A.6.1.2.5.2-4. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both NR cell 1 and E-UTRAN cell 2 are already identified by the UE prior to the start of the test. E-UTRAN cell 2 is of lower priority than cell 1. The E-UTRAN cell 2 is indicated by NR cell 1 as an HST cell.

Table A.6.1.2.5.2-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, TDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	LTE 10 MHz bandwidth, FDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.1.2.5.2-2: General test parameters for NR to E-UTRAN cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE camps on cell 1 in the initial phase.
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell2	The UE shall perform reselection to cell 2 during T1.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE shall perform reselection to cell 1 during T2 for iteration of the tests.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell2	
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	320ms	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	77	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
E-UTRAN PRACH configuration index			1, 2, 3, 4, 5, 6	53	As specified in table 5.7.1-2 in TS 36.211 [23]
T1		s	1, 2, 3, 4, 5, 6	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.6.1.2.5.2-3: Cell specific test parameters for NR cell 1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2

TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH RMC configuration		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET RMC configuration		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
SMTC configuration		1, 4	SMTC pattern 2	
		2, 5	SMTC pattern 1	
		3, 6	SMTC pattern 1	
OCNG Pattern		1, 2, 3, 4, 5, 6	OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
N_{oc}	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc}	dBm/15 kHz	1, 2, 3, 4, 5, 6	-98	
SS-RSRP	dBm/SCS	1, 4	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
$\hat{E}_s/I_{ot}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
$\hat{E}_s/N_{oc}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
Io	dBm/9.36 MHz	1, 4	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-51.69
Treselection	S	1, 2, 3, 4, 5, 6	0	
Snonintrasearch	dB	1, 2, 3, 4, 5, 6	50	
$\text{Thresh}_{\text{x, high (Note 2)}}$	dB	1, 2, 3, 4, 5, 6	48	
$\text{Thresh}_{\text{serving, low}}$	dB	1, 2, 3, 4, 5, 6	44	
$\text{Thresh}_{\text{x, low}}$	dB	1, 2, 3, 4, 5, 6	50	
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN 1944Hz[Note3]	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: This refers to the value of $\text{Thresh}_{\text{x, high}}$ which is included in NR system information, and is a threshold for the E-UTRA target cell. Note 3: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.				

Table A.6.1.2.5.2-4: Cell specific test parameters for E-UTRA cell 2

Parameter	Unit	Cell 2	
		T1	**T2 T3**
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc}	dBm/15 kHz	-98	
RSRP	dBm/15 KHz	-84	-84
$\hat{E}_s/I_{ot}$	dB	14	14
$\hat{E}_s/N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	S	0	
Snonintrasearch	dB	Not sent	
$Thresh_{x, high}$ (Note 2)	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN 1944Hz	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: This refers to the value of $Thresh_{x, high}$ which is included in E-UTRA system information, and is a threshold for the NR target cell			

A.6.2 SA: RRC_INACTIVE state mobility

A.6.3 RRC_CONNECTED state mobility

A.6.3.1 Handover

A.6.3.1.1 Intra-frequency handover from FR1 to FR1; known target cell

A.6.3.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra frequency handover requirements specified in clause 6.1.1.2.

A.6.3.1.1.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.1.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.1.2-2, and A.6.3.1.1.2-3.

The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE may not have any timing information of cell 2.

NR shall send a RRC message implying handover to cell 2. The RRC message implying handover shall be sent to the UE during period T2, after the UE has reported Event A3. T3 is defined as the end of the last TTI containing the RRC message implying handover.

Table A.6.3.1.1.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.1.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.6.3.1.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency handover test case

Parameter		Unit	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
NR RF Channel Number			1			1		
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52					
	Config 2		10: $N_{RB,c}$ = 52					
	Config 3		40: $N_{RB,c}$ = 106					
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52					
	Config 2		10: $N_{RB,c}$ = 52					
	Config 3		40: $N_{RB,c}$ = 106					
DRx Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD					
	Config 2		SR.1.1 TDD					
	Config 3		SR2.1 TDD					
CORESET Reference Channel	Config 1		CR.1.1 FDD					
	Config 2		CR.1.1 TDD					
	Config 3		CR2.1 TDD					
TRS configuration	Config 1		TRS.1.1 FDD					
	Config 2		TRS.1.1 TDD					
	Config 3		TRS.1.2 TDD					
OCNG Patterns			OP.1					
SMTC Configuration			SMTC.1					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
PRACH configuration			FR1 PRACH configuration 1					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2		dBm/15kHz	-98					
N_{oc} Note2	Config 1,2	dBm/SCS	-98					
	Config 3		-95					
$\hat{E}_s/I_{ot}$		dB	8	-3.3	-3.3	-Infinity	2.36	2.36

$\hat{E}_s/N_{oc}$		dB	8	8	8	-Infinity	11	11
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-Infinity	-87	-87
	Config 3	dBm/SCS	-87	-87	-87	-Infinity	-84	-84
Io[Note3]	Config 1,2	dBm/ 9.36MHz	-61.41	-57.06	-57.06	-61.41	-57.06	-57.06
	Config 3	dBm/ 38.16MHz	-55.31	-50.96	-50.96	-55.31	-50.96	-50.96
Propagation condition		-	AWGN			AWGN		
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.6.3.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3.
The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 62 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

A.6.3.1.2 Intra-frequency handover from FR1 to FR1; unknown target cell

A.6.3.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra frequency handover requirements specified in clause 6.1.1.2.

A.6.3.1.2.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.2.2-2, and A.6.3.1.2.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.6.3.1.2.2-1: Intra-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.2.2-2: General test parameters Intra-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	$\leq$5	

Table A.6.3.1.2.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf. 2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s/I_{ot}$		dB	8	-0.64	-Infinity	-0.64

$\hat{E}_s/N_{oc}$		dB	8	8	-Infinity	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-Infinity	-90
	Config 3	dBm/SCS	-87	-87	-Infinity	-87
Io[Note3]	Config 1,2	dBm/ 9.36MHz	-61.41	-58.71	-61.41	-58.71
	Config 3	dBm/ 38.16MHz	-55.31	-52.60	-55.31	-52.60
Propagation condition		-	AWGN		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.3.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 92 ms from the beginning of time period T2. The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 82 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 92 ms.

A.6.3.1.3 Inter-frequency handover from FR1 to FR1; unknown target cell

A.6.3.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 inter frequency handover requirements specified in clause 6.1.1.2.

A.6.3.1.3.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.3.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.3.2-2, and A.6.3.1.3.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.6.3.1.3.2-1: Inter-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.3.2-2: General test parameters Inter-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤5	

Table A.6.3.1.3.2-3: Cell specific test parameters for NR FR1-FR1 Inter frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OP.1			
SMTC Configuration			SMTC.1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	
$\hat{E}_s/I_{ot}$		dB	4	4	-Infinity	5

$\hat{E}_s/N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io Note3	Config 1,2	dBm/ 9.36MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.3.1.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 132 ms from the beginning of time period T2. The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 122 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.2.2.

This gives a total of 132 ms.

A.6.3.1.4 SA NR - E-UTRAN handover

A.6.3.1.4.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements as specified in clause 6.1.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in Table 9.1.2-1 is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.6.3.1.4-1. General test parameters are provided in Table A.6.3.1.4-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in Tables A.6.3.1.4-3 and A.6.3.1.4-4 respectively.

Table A.6.3.1.4-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.4-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
b2-Threshold1		dBm	As specified in Table A.6.3.1.4-3	Absolute NR SS-RSRP threshold for event B2
b2-Threshold2EUTRAN		dBm	-98	Absolute E-UTRAN RSRP threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in Table 9.1.2-1 started before T2 starts
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.6.3.1.4-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6	1		
Duplex mode			1, 4	FDD		
			2, 3, 5, 6	TDD		
TDD Configuration			2, 5	TDDConf.1.1		
			3, 6	TDDConf.1.2		
$BW_{channel}$		MHz	1, 4	10: $N_{RB,c}$ = 52 (FDD)		
			2, 5	10: $N_{RB,c}$ = 52 (TDD)		
			3, 6	40: $N_{RB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1, 4	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
TRS configuration			1, 4	TRS.1.1 FDD		
			2, 5	TRS.1.1 TDD		
			3, 6	TRS.1.2 TDD		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration			1, 2, 4, 5	SSB.1 FR1		
			3, 6	SSB.2 FR1		
b2-Threshold1		dBm	1, 2, 4, 5	-96		
			3, 6	-93		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-100	-104	-100
N_{oc}[Note2]		dBm/SCS	1, 2, 4, 5	-100	-104	-100
			3, 6	-97	-101	-97
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	12	0	-4
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3, 4, 5, 6	12	0	-4
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-88	-104	-104
			3, 6	-85	-101	-101
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-59.78	-73.04	-70.59
		dBm/38.16 MHz	3, 6	-53.68	-66.9448	-64.49
Propagation condition			1, 2, 3, 4, 5, 6	AWGN		

Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

Table A.6.3.1.4-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2		
			T1	T2	T3

RF channel number		1, 2, 3, 4, 5, 6	2		
Duplex mode		1, 2, 3	FDD		
		4, 5, 6	TDD		
TDD special subframe configuration[Note1]		4, 5, 6	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100		
PRACH Configuration[Note2]		1, 2, 3	4		
		4, 5, 6	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD		
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note4]					
OCNG_RB[Note4]					
N_{oc}[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	8	78
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6	-Infinity	78	78
RSRP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-90	-90
SCH_RP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-90	-90
Io[Note6]	dBm/9MHz	1, 2, 3, 4, 5, 6	-67.21 +10log($N_{RB,c}$/100)	-58.57 +10log($N_{RB,c}$/100)	-58.57 +10log($N_{RB,c}$/100)
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix Note7		1, 2, 3, 4, 5, 6	1x2 Low		

Note 1:	Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2:	PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
Note 3:	DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 4:	OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 5:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 6:	$\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 7:	Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.6.3.1.4.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 85 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in clause 6.1.2.1.

$T_{interrupt}$ = 35 ms in the test; $T_{interrupt}$ is defined in clause 6.1.2.1.

This gives a total of 85 ms.

A.6.3.1.5 SA NR - E-UTRAN handover with unknown target cell

A.6.3.1.5.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT E-UTRAN handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to E-UTRAN handover requirements for the case when the target E-UTRAN cell is unknown as specified in clause 6.1.2.1.

The test comprises of one NR carrier and one E-UTRA carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN neighbour cell. The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable. No Gap pattern shall be configured.

A RRC message implying handover shall be sent to the UE during period T1. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.6.3.1.5-1. General test parameters are provided in Table A.6.3.1.5-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in Tables A.6.3.1.5-3 and A.6.3.1.5-4 respectively.

Table A.6.3.1.5-1: Supported test configurations for SA inter-RAT E-UTRAN handover tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.5-2: General test parameters for SA inter-RAT E-UTRAN handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	E-UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
T1		s	≤5	
T2		s	1	

Table A.6.3.1.5-3: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 1)

Parameter	Unit	Configuration	Cell 1	
			T1	T2

RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 4	FDD	
			2, 3, 5, 6	TDD	
TDD Configuration			2, 5	TDDConf.1.1	
			3, 6	TDDConf.1.2	
$BW_{channel}$		MHz	1, 4	10: $N_{RB,c}$ = 52 (FDD)	
			2, 5	10: $N_{RB,c}$ = 52 (TDD)	
			3, 6	40: $N_{RB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
TRS configuration			1, 4	TRS.1.1 FDD	
			2, 5	TRS.1.1 TDD	
			3, 6	TRS.1.2 TDD	
OCNG pattern^{Note1}			1, 2, 3, 4, 5, 6	OP.1	
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP			DLBWP.1.1	
	Initial UL BWP			ULBWP.0.1	
	Dedicated UL BWP			ULBWP.1.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}^{Note2}		dBm/15 KHz	1, 2, 3, 4, 5, 6	-98	
N_{oc}^{Note2}		dBm/SCS	1, 2, 4, 5	-98	
			3, 6	-95	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	0	0
$\hat{E}_s/I_{ot}$^{Note3}		dB	1, 2, 3, 4, 5, 6	0	0
SS-RSRP^{Note3}		dBm/SCS	1, 2, 4, 5	-98	-98
			3, 6	-95	-95
Io^{Note3}		dBm/9.36 MHz	1, 2, 4, 5	-67.04	-67.04
		dBm/38.16 MHz	3, 6	-60.94	-60.94
Propagation condition			1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low	

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	$\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.3.1.5-4: Cell specific test parameters for SA inter-RAT E-UTRA handover (Cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3	4	
		4, 5, 6	53	
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note4]				
OCNG_RB[Note4]				
N_{oc}[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6	-Infinity	7
RSRP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-91
SCH_RP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-91
Io[Note6]	dBm/9MHz	1, 2, 3, 4, 5, 6	-70.22	-62.43
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix [Note7]		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1:	Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2:	PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
Note 3:	DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 4:	OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 5:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 6:	$\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 7:	Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.6.3.1.5.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 165 ms from the beginning of time period T2.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in clause 6.1.2.1.

$T_{interrupt}$ = 115 ms in the test; $T_{interrupt}$ is defined in clause 6.1.2.1.

This gives a total of 165 ms.

A.6.3.1.6 SA NR - UTRAN FDD handover

A.6.3.1.6.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE can make correct inter-RAT UTRAN FDD handover when operating in standalone (SA) operation with PCell in FR1. This test shall verify the NR to UTRAN FDD handover requirements as specified in clause 6.1.2.2.1.

The test comprises of one NR carrier and one UTRA FDD carrier. There are two cells and one cell on each carrier. Cell 1 is the NR PCell and Cell 2 is an inter-RAT UTRAN FDD neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in Table 9.1.2-1 is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.6.3.1.6-1. General test parameters are provided in Table A.6.3.1.6-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in Tables A.6.3.1.6-3 and A.6.3.1.6-4 respectively.

Table A.6.3.1.6-1: Supported test configurations for SA inter-RAT UTRAN FDD handover tests

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, UTRAN FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, UTRAN FDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.6-2: General test parameters for SA inter-RAT UTRAN FDD handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
UTRA RF Channel Number			2	1 UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	NR cell
	Neighbouring cell		Cell 2	UTRAN cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
Inter-RAT (UTRAN FDD) measurement quantity			CPICH Ec/N0	
b2-Threshold1		dBm	As specified in Table A.6.3.1.6-3	Absolute NR SS-RSRP threshold for event B2
b2-Threshold2-UTRA		dB	-18	Absolute UTRAN CPICH Ec/Io threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in Table 9.1.2-1 started before T2 starts
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.6.3.1.6-3: Cell specific test parameters for SA inter-RAT UTRAN FDD handover (Cell 1)

Parameter		Unit	Configuration	Cell 1		
				T1	T2	T3
RF channel number			1, 2, 3	1		
Duplex mode			1	FDD		
			2, 3	TDD		
TDD Configuration			2	TDDConf.1.1		
			3	TDDConf.1.2		
$BW_{channel}$		MHz	1	10: $N_{RB,c}$ = 52 (FDD)		
			2	10: $N_{RB,c}$ = 52 (TDD)		
			3	40: $N_{RB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1	SR.1.1 FDD		
			2	SR.1.1 TDD		
			3	SR.2.1 TDD		
CORSET reference channel			1	CR.1.1 FDD		
			2	CR.1.1 TDD		
			3	CR.2.1 TDD		
TRS configuration			1	TRS.1.1 FDD		
			2	TRS.1.1 TDD		
			3	TRS.1.2 TDD		
OCNG pattern^{Note1}			1, 2, 3	OP.1		
BWP	Initial DL BWP		1, 2, 3	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3	SMTC.1		
SSB configuration			1, 2	SSB.1 FR1		
			3	SSB.2 FR1		
b2-Threshold1		dBm	1, 2	-96		
			3	-93		
EPRE ratio of PSS to SSS		dB	1, 2, 3	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc}^{Note2}		dBm/15 KHz	1, 2, 3	-100		
N_{oc}^{Note2}		dBm/SCS	1, 2,	-100		
			3	-97		
$\hat{E}_s/N_{oc}$		dB	1, 2, 3	012	0-4	0-4
$\hat{E}_s/I_{ot}^{Note3}$		dB	1, 2, 3	012	0-4	0-4
SS-RSRP^{Note3}		dBm/SCS	1, 2	-88	-104	-104
			3	-85	-101	-101
Io^{Note3}		dBm/9.36 MHz	1, 2	-59.78	-70.59	-70.59
		dBm/38.16 MHz	3	-53.68	-64.49	-64.49
Propagation condition			1, 2, 3	AWGN		

Antenna Configuration and Correlation Matrix		1, 2, 3	1x2 Low
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: $\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

Table A.6.3.1.6-4: Cell specific test parameters for SA inter-RAT UTRAN FDD handover (Cell 2)

Parameter	Unit	Cell 2 (UTRA)		
		T1	T2	T3
CPICH_Ec/Ior	dB	-10		
PCCPCH_Ec/Ior	dB	-12		
SCH_Ec/Ior	dB	-12		
PICH_Ec/Ior	dB	-15		
DCH_Ec/Ior	dB	N/A	N/A	Note 1
OCNS_Ec/Ior	dB	-0.941	0.941	Note 2
$\hat{I}_{or}/I_{oc}$	dB	-infinity	-1.8	-1.8
I_{oc}	dBm/3,84 MHz	-70	-70	-70
CPICH_Ec/Io	dB	-infinity	-14	-14
Propagation Condition		AWGN		
Note 1: The DPCH level is controlled by the power control loop Note 2: The power of the OCNS channel that is added shall make the total power from the cell to be equal to I_{or}.				

A.6.3.1.6.2 Test Requirements

The UE shall start to transmit the UL DPCCH to Cell 2 less than 190 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms, which is specified in clause 5.3.1.1.1.

$T_{interrupt}$ = 140 ms in the test; $T_{interrupt}$ is defined in clause 5.3.1.1.2. This gives a total of 190 ms.

A.6.3.1.7 Intra-frequency handover in FR1; synchronous scenario

A.6.3.1.7.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra frequency DAPS handover requirements in synchronous scenario specified in clause 6.1.3.2.

A.6.3.1.7.2 Test Parameters

Supported test configurations are shown in Table A.6.3.1.7.2-1. Both handover delay and interruption length are tested by using the parameters in Table A.6.3.1.7.2-2, and A.6.3.1.7.2-3.The test consists of five successive time periods, with time durations of T1, T2, T3, T4, and T5 respectively.

Before the start of T1, the UE is connected to the cell1 and not aware of the cell2. During T1, the UE does not have any timing information of the cell2.

Starting T2, the cell2 becomes detectable. During T2, the UE performs cell detection and measurements on the cell2 and shall send event report to the network. After receiving the event report A3, the network sends a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing DAPS handover command is sent to the UE. During T3, UE shall be able to perform random access, DL reception or UL transmission in the cell2 while the DL scheduling and UL feedback in the cell1 shall be avoided. After successful RACH procedure of the cell2, UE is scheduled with PDSCH from cell1 and cell2 in alternative TTIs where both cell1 and cell2 belong to the same TAG. In the end the network sends a RRC message implying cell1 release to the UE. During T3, the handover delay $D_{handover1}$ for target cell addition need to be verified.

The start of T4 is the instant when the last TTI containing cell1 release command is sent to the UE. During T4, the UE shall accomplish the release actions within $D_{handover2}$.

Starting T5, the UE stops sending the periodical CSI report to the cell1.

Table A.6.3.1.7.2-1: Intra-frequency DAPS handover in FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.7.2-2: General test parameters synchronous Intra-frequency DAPS handover in FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	
T4		ms	$D_{handover2}$	$D_{Handover2}$ is defined in clause 6.1.3.2.1
T5		ms	100	

Table A.6.3.1.7.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency DAPS handover test case

Parameter		Unit	Cell 1					Cell 2				
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
NR RF Channel Number			1					1				
Duplex mode	Config 1		FDD									
	Config 2,3		TDD									
TDD configuration	Config 1		Not Applicable									
	Config 2		TDDConf.1.1									
	Config 3		TDDConf.2.1									
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52									
	Config 2		10: $N_{RB,c}$ = 52									
	Config 3		40: $N_{RB,c}$ = 106									
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52									
	Config 2		10: $N_{RB,c}$ = 52									
	Config 3		40: $N_{RB,c}$ = 106									
DRX Cycle		ms	Not Applicable									
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD									
	Config 2		SR.1.1 TDD									
	Config 3		SR2.1 TDD									
CORESET Reference Channel	Config 1		CR.1.1 FDD									
	Config 2		CR.1.1 TDD									
	Config 3		CR2.1 TDD									
TRS configuration	Config 1		TRS.1.1 FDD									
	Config 2		TRS.1.1 TDD									
	Config 3		TRS.1.2 TDD									
OCNG Patterns			OP.1									
SMTC Configuration			SMTC.1									
SSB Configuration	Config 1,2		SSB.1 FR1									
	Config 3		SSB.2 FR1									
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz									
	Config 3		30 kHz									
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz									
	Config 3		30 kHz									
PRACH configuration			FR1 PRACH configuration 1									
BWP configuration	Initial DL BWP		DLBWP.0.1									
	Dedicated DL BWP		DLBWP.1.1									
	Initial UL BWP		ULBWP.0.1									
	Dedicated UL BWP		ULBWP.1.1									
EPRE ratio of PSS to SSS		dB	0									
EPRE ratio of PBCH DMRS to SSS												
EPRE ratio of PBCH to PBCH DMRS												
EPRE ratio of PDCCH DMRS to SSS												
EPRE ratio of PDCCH to PDCCH DMRS												
EPRE ratio of PDSCH DMRS to SSS												
EPRE ratio of PDSCH to PDSCH												
EPRE ratio of OCNG DMRS to SSS(Note 1)												

EPRE ratio of OCNG to OCNG DMRS (Note 1)												
N_{oc} Note2		dBm/15kHz	-98									
N_{oc} Note2	Config 1,2	dBm/SCS	-98									
	Config 3		-95									
$\hat{E}_s/I_{ot}$		dB	8	-1.5	-1.5	-1.5	-1.5	-Infinity	0.36	0.36	0.36	0.36
$\hat{E}_s/N_{oc}$		dB	8	8	8	8	8	-Infinity	9	9	9	9
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-90	-90	-89	-89	-89	-89	-89
	Config 3	dBm/SCS	-87	-87	-87	-87	-87	-86	-86	-86	-86	-86
Io Note3	Config 1,2	dBm/9.36MHz	-61.41	-58.21	-58.21	-58.21	-58.21	-61.41	-58.21	-58.21	-58.21	-58.21
	Config 3	dBm/38.16MHz	-55.31	-52.11	-52.11	-52.11	-52.11	-55.31	-52.11	-52.11	-52.11	-52.11
Propagation condition			AWGN									

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.7.3 Test Requirements

The UE shall start to transmit the PRACH to cell 2 less than 72 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The target cell add delay $D_{handover1}$ can be expressed as: $T_{RRC\_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.2.2.

If the target cell is known, then T_{search} = 0 ms

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 20 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

After successful RACH to cell 2 and until the start of time period T4, UE shall be able to receive PDSCH alternatively from cell 1 and cell 2. UE is not expected to transmit UL to both cell 1 and cell 2 in the same TTI.

The UE shall release cell 1 less than $D_{handover2} = (T_{RRC\_procedure} + T_{interrupt2})$ from the beginning of time period T4.

NOTE: $D_{handover2}$ is defined in clause 6.1.3.2.1.

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.2.2.

UE shall not report CSI to cell 1 during T5.

A.6.3.1.8 Intra-frequency handover in FR1; asynchronous scenario

A.6.3.1.8.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra frequency DAPS handover requirements in asynchronous scenario specified in clause 6.1.3.2.

A.6.3.1.8.2 Test Parameters

Supported test configurations are shown in Table A.6.3.1.8.2-1. Both handover delay and interruption length are tested by using the parameters in Table A.6.3.1.8.2-2, and A.6.3.1.8.2-3.

The test consists of five successive time periods, with time durations of T1, T2, T3, T4, and T5 respectively.

Before the start of T1, the UE is connected to the cell1 and not aware of the cell2. During T1, the UE does not have any timing information of the cell2.

Starting T2, the cell2 becomes detectable. During T2, the UE performs cell detection and measurements on the cell2 and shall send event report to the network. After receiving the event report A3, the network sends a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing DAPS handover command is sent to the UE. During T3, UE shall be able to perform random access, DL reception or UL transmission in the cell2 while the DL scheduling and UL feedback in the cell1 shall be avoided. After successful RACH procedure of the cell2, UE is scheduled with PDSCH from cell1 and cell2 in alternative TTIs where both cell1 and cell2 belong to the same TAG. In the end the network sends a RRC message implying cell1 release to the UE. During T3, the handover delay $D_{handover1}$ for target cell addition needs to be verified.

The start of T4 is the instant when the last TTI containing cell1 release command is sent to the UE by cell2. During T4, the UE shall accomplish the release actions within $D_{handover2}$.

Starting T5, the UE stops sending the periodical CSI report to the cell1.Table A.6.3.1.8.2-1: Intra-frequency DAPS handover in FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.8.2-2: General test parameters Intra-frequency asynchronous DAPS handover in FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			7 µs	Asynchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	
T4		ms	$D_{handover2}$	$D_{Handover2}$ is defined in clause 6.1.3.2.1
T5		ms	100	

Table A.6.3.1.8.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency DAPS handover test case

Parameter		**Unit**	**Cell 1**					**Cell 2**				
			T1	**T2**	**T3**	**T4**	**T5**	**T1**	**T2**	**T3**	**T4**	**T5**
NR RF Channel Number			1					1				
Duplex mode	Config 1		FDD									
	Config 2,3		TDD									
TDD configuration	Config 1		Not Applicable									
	Config 2		TDDConf.1.1									
	Config 3		TDDConf.2.1									
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52									
	Config 2		10: $N_{RB,c}$ = 52									
	Config 3		40: $N_{RB,c}$ = 106									
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52									
	Config 2		10: $N_{RB,c}$ = 52									
	Config 3		40: $N_{RB,c}$ = 106									
DRX Cycle		ms	Not Applicable									
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD									
	Config 2		SR.1.1 TDD									
	Config 3		SR2.1 TDD									
CORESET Reference Channel	Config 1		CR.1.1 FDD									
	Config 2		CR.1.1 TDD									
	Config 3		CR2.1 TDD									
TRS configuration	Config 1		TRS.1.1 FDD									
	Config 2		TRS.1.1 TDD									
	Config 3		TRS.1.2 TDD									
OCNG Patterns			OP.1									
SMTC Configuration			SMTC.1									
SSB Configuration	Config 1,2		SSB.1 FR1									
	Config 3		SSB.2 FR1									
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz									
	Config 3		30 kHz									
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz									
	Config 3		30 kHz									
PRACH configuration			FR1 PRACH configuration 1									
BWP configuration	Initial DL BWP		DLBWP.0.1									
	Dedicated DL BWP		DLBWP.1.1									
	Initial UL BWP		ULBWP.0.1									
	Dedicated UL BWP		ULBWP.1.1									
EPRE ratio of PSS to SSS		dB	0									
EPRE ratio of PBCH DMRS to SSS												
EPRE ratio of PBCH to PBCH DMRS												
EPRE ratio of PDCCH DMRS to SSS												
EPRE ratio of PDCCH to PDCCH DMRS												
EPRE ratio of PDSCH DMRS to SSS												

EPRE ratio of PDSCH to PDSCH												
EPRE ratio of OCNG DMRS to SSS(Note 1)												
EPRE ratio of OCNG to OCNG DMRS (Note 1)												
N_{oc} Note2		dBm/15kHz	-98									
N_{oc} Note2	Config 1,2	dBm/SCS	-98									
	Config 3		-95									
$\hat{E}_s/I_{ot}$		dB	8	-1.5	-1.5	-1.5	-1.5	-Infinity	0.36	0.36	0.36	0.36
$\hat{E}_s/N_{oc}$		dB	8	8	8	8	8	-Infinity	9	9	9	9
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-90	-90	-89	-89	-89	-89	-89
	Config 3	dBm/SCS	-87	-87	-87	-87	-87	-86	-86	-86	-86	-86
Io Note3	Config 1,2	dBm/ 9.36MHz	-61.41	-58.21	-58.21	-58.21	-58.21	-61.41	-58.21	-58.21	-58.21	-58.21
	Config 3	dBm/ 38.16MHz	-55.31	-52.11	-52.11	-52.11	-52.11	-55.31	-52.11	-52.11	-52.11	-52.11
Propagation condition			AWGN									

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.1.8.3 Test Requirements

The UE shall start to transmit the PRACH to cell 2 less than 72 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The target cell add delay $D_{handover1}$ can be expressed as: $T_{RRC\_procedure} + T_{search} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{search}, T_{IU}, $T_{processing}$, T_{Δ} and T_{margin} are defined in clause 6.1.1.2.2.

If the target cell is known, then T_{search} = 0 ms

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 20 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

After successful RACH to cell 2 and until the start of time period T4, UE shall be able to receive PDSCH alternatively from cell 1 and cell 2. UE is not expected to transmit UL to both cell 1 and cell 2 in the same TTI.

The UE shall release cell 1 less than $D_{handover2} = (T_{RRC\_procedure} + T_{interrupt2})$ from the beginning of time period T4.

NOTE: $D_{handover2}$ is defined in clause 6.1.3.2.1.

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt2}$ is defined in clause 6.1.3.2.2.

UE shall not report CSI to cell 1 during T5.

A.6.3.1.9 Intra-band inter-frequency synchronous DAPS handover test in SA for FR1

A.6.3.1.9.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-band inter-frequency synchronous DAPS handover requirements specified in clause 6.1.3.2.

A.6.3.1.9.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.9.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.9.2-2, and A.6.3.1.9.2-3.

The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively. At the start of time duration T1, the UE may not have any timing information of cell 2. The test scenario comprises of two carriers and one cell on each carrier Gap pattern ID gp0 as specified in Table 9.1.2-1 is configured before T2 in the test case.

Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC message implying DAPS handover to the UE.

T3 is defined as the end of the last TTI containing the RRC message implying DAPS handover. During T3 UE shall be able to perform random access to cell 2. Cell 1 is continuously scheduled in DL during T3. DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perfrom DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission. At the end of T3 cell 2 shall send an RRC message implying cell 1 release command.

T4 is defined as the end of the last TTI containing the RRC message implying DAPS handover. Cell 2 is continuously scheduled in DL during T4. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stops to send CSI report to the source cell. And the test system shall observe the periodic reporting of CSI for cell 1 during T5.

Table A.6.3.1.9.2-1: Intra-band inter-frequency synchronous DAPS handover in SA for FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.9.2-2: General test parameters for intra-band inter-frequency synchronous DAPS handover test in SA for FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			0 μs	Synchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	
T4		ms	10 + $T_{interrupt2}$	$T_{interrupt2}$ is defined in clause 6.1.3.2.2 Table 6.1.3.2.2-5
T5		ms	100	

Table A.6.3.1.9.2-3: Cell specific test parameters for intra-band inter-frequency synchronous DAPS handover test in SA for FR1

Parameter		Unit	Cell 1					Cell 2				
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
NR RF Channel Number			1					2				
Duplex mode	Config 1		FDD									
	Config 2,3		TDD									
TDD configuration	Config 1		Not Applicable									
	Config 2		TDDConf.1.1									
	Config 3		TDDConf.2.1									
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52									
	Config 2		10: $N_{RB,c}$ = 52									
	Config 3		40: $N_{RB,c}$ = 106									
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52									
	Config 2		10: $N_{RB,c}$ = 52									
	Config 3		40: $N_{RB,c}$ = 106									
DRx Cycle		ms	Not Applicable									
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD									
	Config 2		SR.1.1 TDD									
	Config 3		SR2.1 TDD									
CORESET Reference Channel	Config 1		CR.1.1 FDD									
	Config 2		CR.1.1 TDD									
	Config 3		CR2.1 TDD									
TRS configuration	Config 1		TRS.1.1 FDD									
	Config 2		TRS.1.1 TDD									
	Config 3		TRS.1.2 TDD									
OCNG Patterns			OP.1									
SMTC Configuration			SMTC.1									
SSB Configuration	Config 1,2		SSB.1 FR1									
	Config 3		SSB.2 FR1									
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz									
	Config 3		30 kHz									
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz									
	Config 3		30 kHz									
PRACH configuration			FR1 PRACH configuration 1									
BWP configuration	Initial DL BWP		DLBWP.0.1									
	Dedicated DL BWP		DLBWP.1.1									
	Initial UL BWP		ULBWP.0.1									
	Dedicated UL BWP		ULBWP.1.1									
EPRE ratio of PSS to SSS		dB	0									
EPRE ratio of PBCH DMRS to SSS												
EPRE ratio of PBCH to PBCH DMRS												
EPRE ratio of PDCCH DMRS to SSS												
EPRE ratio of PDCCH to PDCCH DMRS												
EPRE ratio of PDSCH DMRS to SSS												
EPRE ratio of PDSCH to PDSCH												
EPRE ratio of OCNG DMRS to SSS(Note 1)												
EPRE ratio of OCNG to OCNG DMRS (Note 1)												
N_{oc} Note2		dBm/15kHz	-98									
N_{oc} Note2	Config 1,2	dBm/SCS	-98									
	Config 3		-95									

$\hat{E}_s / I_{ot}$		dB	8	8	8	8	8	-Infinity	8	8	8	8
$\hat{E}_s / N_{oc}$		dB	8	8	8	8	8	-Infinity	8	8	8	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-90	-90	-Infinity	-90	-90	-90	-90
	Config 3	dBm/SCS	-87	-87	-87	-87	-87	-Infinity	-87	-87	-87	-87
Io Note3	Config 1,2	dBm/ 9.36MHz	-61.41	-61.41	-61.41	-61.41	-61.41	-70.05	-61.41	-61.41	-61.41	-61.41
	Config 3	dBm/ 38.16MHz	-55.31	-55.31	-55.31	-55.31	-55.31	-63.94	-55.31	-55.31	-55.31	-55.31
Propagation condition		-	AWGN					AWGN				
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.												

A.6.3.1.9.3 Test Requirements

The UE shall start to transmit the PRACH to cell 2 less than 72 ms from the beginning of time period T3.

During T3 UE is allowed to cause $T_{interrupt1}$ interruption to cell 1. $T_{interrupt1}$ is defined in clause 6.1.3.2.2 Table 6.1.3.2.2-2. When UE is transmitting PRACH preamble to cell 2, interruption to cell 1 is allowed.

During T4 UE is allowed to cause $T_{interrupt2}$ interruption to cell 1. $T_{interrupt2}$ is defined in clause 6.1.3.2.2 Table 6.1.3.2.2-5.

UE shall finish cell 1 release in T4 and shall not send any CSI reports to cell 1 during T5.

The rate of correct handovers observed during repeated tests shall be at least 90%.

A.6.3.1.10 Intra-band inter-frequency asynchronous DAPS handover test in SA for FR1

A.6.3.1.10.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra-band inter-frequency asynchronous DAPS handover requirements specified in clause 6.1.3.2.

A.6.3.1.10.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.10.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.10.2-2, and A.6.3.1.10.2-3.

The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively. At the start of time duration T1, the UE may not have any timing information of cell 2. The test scenario comprises of two carriers and one cell on each carrier Gap pattern ID gp0 as specified in Table 9.1.2-1 is configured before T2 in the test case.

Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC message implying DAPS handover to the UE.

T3 is defined as the end of the last TTI containing the RRC message implying DAPS handover.During T3 UE shall be able to perform random access to cell 2. Cell 1 is continuously scheduled in DL during T3. DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perfrom DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission. At the end of T3 cell 2 shall send an RRC message implying cell 1 release command.

T4 is defined as the end of the last TTI containing the RRC message implying DAPS handover. Cell 2 is continuously scheduled in DL during T4. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stops to send CSI report to the source cell. Andthe test system shall observe the periodic reporting of CSI for cell 1 during T5.

Table A.6.3.1.10.2-1: Intra-band inter-frequency asynchronous DAPS handover in SA for FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.10.2-2: General test parameters for intra-band inter-frequency asynchronous DAPS handover test in SA for FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			10 µs	Asynchronous cells
T1		s	5	
T2		s	≤5	
T3		s	1	
T4		ms	10 + $T_{interrupt2}$	$T_{interrupt2}$ is defined in clause 6.1.3.2.2 Table 6.1.3.2.2-5
T5		ms	100	

Table A.6.3.1.10.2-3: Cell specific test parameters for intra-band inter-frequency asynchronous DAPS handover test in SA for FR1

Parameter		Unit	Cell 1					Cell 2				
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
NR RF Channel Number			1					2				
Duplex mode	Config 1		FDD									
	Config 2,3		TDD									
TDD configuration	Config 1		Not Applicable									
	Config 2		TDDConf.1.1									
	Config 3		TDDConf.2.1									
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52									
	Config 2		10: $N_{RB,c}$ = 52									
	Config 3		40: $N_{RB,c}$ = 106									
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52									
	Config 2		10: $N_{RB,c}$ = 52									
	Config 3		40: $N_{RB,c}$ = 106									
DRx Cycle		ms	Not Applicable									
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD									
	Config 2		SR.1.1 TDD									
	Config 3		SR2.1 TDD									
CORESET Reference Channel	Config 1		CR.1.1 FDD									
	Config 2		CR.1.1 TDD									
	Config 3		CR2.1 TDD									
TRS configuration	Config 1		TRS.1.1 FDD									
	Config 2		TRS.1.1 TDD									
	Config 3		TRS.1.2 TDD									
OCNG Patterns			OP.1									
SMTC Configuration			SMTC.1									
SSB Configuration	Config 1,2		SSB.1 FR1									
	Config 3		SSB.2 FR1									
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz									
	Config 3		30 kHz									
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz									
	Config 3		30 kHz									
PRACH configuration			FR1 PRACH configuration 1									
BWP configuration	Initial DL BWP		DLBWP.0.1									
	Dedicated DL BWP		DLBWP.1.1									
	Initial UL BWP		ULBWP.0.1									
	Dedicated UL BWP		ULBWP.1.1									
EPRE ratio of PSS to SSS		dB	0									
EPRE ratio of PBCH DMRS to SSS												
EPRE ratio of PBCH to PBCH DMRS												
EPRE ratio of PDCCH DMRS to SSS												
EPRE ratio of PDCCH to PDCCH DMRS												
EPRE ratio of PDSCH DMRS to SSS												
EPRE ratio of PDSCH to PDSCH												
EPRE ratio of OCNG DMRS to SSS(Note 1)												
EPRE ratio of OCNG to OCNG DMRS (Note 1)												
N_{oc} Note2		dBm/15kHz	-98									
N_{oc} Note2	Config 1,2	dBm/SCS	-98									
	Config 3		-95									
$\hat{E}_s/I_{ot}$		dB	8	8	8	8	8	-Infinity	8	8	8	8

$\hat{E}_s/N_{oc}$		dB	8	8	8	8	8	-Infinity	8	8	8	8
SSB_RP	Config 1,2	dBm/SCS	-90	-90	-90	-90	-90	-Infinity	-90	-90	-90	-90
	Config 3	dBm/SCS	-87	-87	-87	-87	-87	-Infinity	-87	-87	-87	-87
Io[Note3]	Config 1,2	dBm/ 9.36MHz	-61.41	-61.41	-61.41	-61.41	-61.41	-70.05	-61.41	-61.41	-61.41	-61.41
	Config 3	dBm/ 38.16MHz	-55.31	-55.31	-55.31	-55.31	-55.31	-63.94	-55.31	-55.31	-55.31	-55.31
Propagation condition		-	AWGN					AWGN				
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.											

A.6.3.1.10.3 Test Requirements

The UE shall start to transmit the PRACH to cell 2 less than 72 ms from the beginning of time period T3.

During T3 UE is allowed to cause $T_{interrupt1}$ interruption to cell 1. $T_{interrupt1}$ is defined in clause 6.1.3.2.2 Table 6.1.3.2.2-2. When UE is transmitting PRACH preamble to cell 2, interruption to cell 1 is allowed.

During T4 UE is allowed to cause $T_{interrupt2}$ interruption to cell 1. $T_{interrupt2}$ is defined in clause 6.1.3.2.2 Table 6.1.3.2.2-5.

UE shall finish cell 1 release in T4 and shall not send any CSI reports to cell 1 during T5.

The rate of correct handovers observed during repeated tests shall be at least 90%.

A.6.3.1.11 Inter-band inter-frequency synchronous DAPS handover from FR1 to FR1

A.6.3.1.11.1 Test Purpose and Environment

This test is to verify the requirement for the FR1-to-FR1 inter-band inter-frequency synchronous DAPS handover requirements specified in clause 6.1.3.2.

A.6.3.1.11.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.11.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.11.2-2, A.6.3.1.11.2-3 and A.6.3.1.11.2-4.

The test scenario comprises of two bands each with one cell. The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively.

Before the start of T1, the UE is connected to Cell 1 (source PCell) on radio channel 1 but is not aware of Cell 2 (neighbour cell) on radio channel 2. During T1, the UE shall not have any timing information of Cell 2.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A3 is configured for neighbour cell (Cell 2), and the UE is configured with the measurement gaps (gap pattern ID # 0). Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC m`essage implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing the RRC message implying DAPS handover to Cell 2 (target PCell) is sent to the UE. During T3, the UE shall be able to perform random access to Cell 2. DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission. After the RACH procedure is completed, the test system shall send a RRC message to the UE to release Cell 1 (source cell) on radio channel 1.

The start of T4 is the instant when the last TTI containing the RRC message implying source cell release is sent to the UE. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stops to send CSI report to the source cell.

Table A.6.3.1.11.2-1: Inter-band inter-frequency synchronous DAPS handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
5	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
7	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
8	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
9	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.11.2-2: General test parameters for inter-band inter-frequency synchronous DAPS handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	PCell on RF channel number 1
	Neighbouring cell		Cell 2	Neighbour cell on RF channel number 2
Final condition	Active cell		Cell 2	PCell on RF channel number 2
	Neighbouring cell		Cell 1	Neighbour cell on RF channel number 1
A3-Offset		dB	-6	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells		μs	33	Synchronous cells
DRX			OFF	
Measurement gap pattern Id			#0	Gaps are configured before T2.
T1		s	5	
T2		s	<5	
T3		s	<0.5	
T4		ms	$10+T_{interrupt2}$	$T_{interrupt2}$ as defined in Table 6.1.3.2.2-6 for synchronous DAPS HO
T5		ms	100	

Table A.6.3.1.11.2-3: Cell specific test parameters for inter-band inter-frequency synchronous DAPS handover from FR1 to FR1 (Cell 1)

Parameter	Unit	Cell 1				
		T1	T2	T3	T4	T5

NR RF Channel Number			1				
Duplex mode	Config 1,4,7		FDD				
	Config 2,3,5,6,8,9		TDD				
TDD configuration	Config 1,4,7		Not Applicable				
	Config 2,5,8		TDDConf.1.1				
	Config 3,6,9		TDDConf.2.1				
$BW_{channel}$	Config 1,4,7	MHz	10: $N_{RB,c}$ = 52				
	Config 2,5,8		10: $N_{RB,c}$ = 52				
	Config 3,6,9		40: $N_{RB,c}$ = 106				
BWP BW	Config 1,4,7	MHz	10: $N_{RB,c}$ = 52				
	Config 2,5,8		10: $N_{RB,c}$ = 52				
	Config 3,6,9		40: $N_{RB,c}$ = 106				
TRS configuration	Config 1,4,7		TRS.1.1 FDD				
	Config 2,5,8		TRS.1.1 TDD				
	Config 3,6,9		TRS.1.2 TDD				
DRX Cycle		ms	Not Applicable				
PDSCH Reference measurement channel	Config 1,4,7		SR.1.1 FDD				
	Config 2,5,8		SR.1.1 TDD				
	Config 3,6,9		SR2.1 TDD				
CORESET Reference Channel	Config 1,4,7		CR.1.1 FDD				
	Config 2,5,8		CR.1.1 TDD				
	Config 3,6,9		CR2.1 TDD				
OCNG Patterns			OCNG pattern 1				
SMTC Configuration			SMTC pattern 1				
SSB Configuration	Config 1,2,4,5,7,8		SSB.1 FR1				
	Config 3,6,9		SSB.2 FR1				
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz				
	Config 3,6,9		30 kHz				
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz				
	Config 3,6,9		30 kHz				
PRACH configuration			FR1 PRACH configuration 2				
BWP	Initial DL BWP		DLBWP.0.1				
	Dedicated DL BWP		DLBWP.1.3				
	Initial UL BWP		ULBWP.0.1				
	Dedicated UL BWP		ULBWP.1.3				
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15kHz	-98	-98	-98	-98	-98
N_{oc} Note2	Config 1,2,4,5,7,8	dBm/SCS	-98	-98	-98	-98	-98
	Config 3,6,9		-95	-95	-95	-95	-95
$\hat{E}_s/I_{ot}$		dB	4	4	4	4	4
$\hat{E}_s/N_{oc}$		dB	4	4	4	4	4

SSB_RP	Config 1,2,4,5,7,8	dBm/SCS	-94	-94	-94	-94	-94
	Config 3,6,9	dBm/SCS	-91	-91	-91	-91	-91
Io[Note3]	Config 1,2,4,5,7,8	dBm/ 9.36MHz	-64.59	-64.59	-64.59	-64.59	-64.59
	Config 3,6,9	dBm/ 38.16MHz	-58.49	-58.49	-58.49	-58.49	-58.49
Propagation condition		-	AWGN				
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

Table A.6.3.1.11.2-4: Cell specific test parameters for inter-band inter-frequency synchronous DAPS handover from FR1 to FR1 (Cell 2)

Parameter		Unit	Cell 2				
			T1	T2	T3	T4	T5
NR RF Channel Number			2				
Duplex mode	Config 1,2,3		FDD				
	Config 4,5,6,7,8,9		TDD				
TDD configuration	Config 1,2,3		Not Applicable				
	Config 4,5,6		TDDConf.1.1				
	Config 7,8,9		TDDConf.2.1				
$BW_{channel}$	Config 1,2,3	MHz	10: $N_{RB,c}$ = 52				
	Config 4,5,6		10: $N_{RB,c}$ = 52				
	Config 7,8,9		40: $N_{RB,c}$ = 106				
BWP BW	Config 1,2,3	MHz	10: $N_{RB,c}$ = 52				
	Config 4,5,6		10: $N_{RB,c}$ = 52				
	Config 7,8,9		40: $N_{RB,c}$ = 106				
TRS configuration	Config 1,2,3		TRS.1.1 FDD				
	Config 4,5,6		TRS.1.1 TDD				
	Config 7,8,9		TRS.1.2 TDD				
DRx Cycle		ms	Not Applicable				
PDSCH Reference measurement channel	Config 1,2,3		SR.1.1 FDD				
	Config 4,5,6		SR.1.1 TDD				
	Config 7,8,9		SR2.1 TDD				
CORESET Reference Channel	Config 1,2,3		CR.1.1 FDD				
	Config 4,5,6		CR.1.1 TDD				
	Config 7,8,9		CR2.1 TDD				
OCNG Patterns			OCNG pattern 1				
SMTC Configuration			SMTC pattern 1				
SSB Configuration	Config 1,2,3,4,5,6		SSB.1 FR1				
	Config 7,8,9		SSB.2 FR1				
PDSCH/PDCCH subcarrier spacing	Config 1,2,3,4,5,6	kHz	15 kHz				
	Config 7,8,9		30 kHz				
PUCCH/PUSCH subcarrier spacing	Config 1,2,3,4,5,6	kHz	15 kHz				
	Config 7,8,9		30 kHz				
PRACH configuration			FR1 PRACH configuration 2				
BWP	Initial DL BWP		DLBWP.0.1				
	Dedicated DL BWP		DLBWP.1.3				
	Initial UL BWP		ULBWP.0.1				
	Dedicated UL BWP		ULBWP.1.3				
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15kHz	-98	-98	-98	-98	-98
N_{oc} Note2	Config 1,2,3,4,5,6	dBm/SCS	-98	-98	-98	-98	-98
	Config 7,8,9		-95	-95	-95	-95	-95
$\hat{E}_s/I_{ot}$		dB	-Infinity	4	4	4	4
$\hat{E}_s/N_{oc}$		dB	-Infinity	4	4	4	4

SSB_RP	Config 1,2,3,4,5,6	dBm/SCS	-Infinity	-94	-94	-94	-94
	Config 7,8,9	dBm/SCS	-Infinity	-91	-91	-91	-91
Io[Note3]	Config 1,2,3,4,5,6	dBm/ 9.36MHz	-70.05	-64.59	-64.59	-64.59	-64.59
	Config 7,8,9	dBm/ 38.16MHz	-63.94	-58.49	-58.49	-58.49	-58.49
Propagation condition		-	AWGN				
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

A.6.3.1.11.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3. During $D_{handover1}$, the interruption on Cell 1 shall not exceed $T_{interrupt1}$ as defined in Table 6.1.3.2.2-3 for synchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay $D_{handover1}$ can be expressed as: $T_{RRC\_procedure} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 20 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

The UE shall complete to release Cell 1 less than (10 ms + $T_{interrupt2}$) from the beginning of time period T4. During $D_{handover2}$, the interruption on Cell 2 shall not exceed $T_{interrupt2}$ as defined in Table 6.1.3.2.2-6 for synchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay $D_{handover2}$ can be expressed as: $T_{RRC\_procedure} + T_{interrupt2}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

A.6.3.1.12 Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1

A.6.3.1.12.1 Test Purpose and Environment

This test is to verify the requirement for the FR1-to-FR1 inter-band inter-frequency asynchronous DAPS handover requirements specified in clause 6.1.3.2.

A.6.3.1.12.2 Test Parameters

Supported test configurations are shown in table A.6.3.1.12.2-1. Both handover delay and interruption length are tested by using the parameters in table A.6.3.1.12.2-2, A.6.3.1.12.2-3 and A.6.3.1.12.2-4.

The test scenario comprises of two bands each with one cell. The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively.

Before the start of T1, the UE is connected to Cell 1 (source PCell) on radio channel 1 but is not aware of Cell 2 (neighbour cell) on radio channel 2. During T1, the UE shall not have any timing information of Cell 2.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A3 is configured for neighbour cell (Cell 2), and the UE is configured with the measurement gaps (gap pattern ID # 0). Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing the RRC message implying DAPS handover to Cell 2 (target PCell) is sent to the UE. During T3, the UE shall be able to perform random access to Cell 2. DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission. After the RACH procedure is completed, the test system shall send a RRC message to the UE to release Cell 1 (source cell) on radio channel 1.

The start of T4 is the instant when the last TTI containing the RRC message implying source cell release is sent to the UE. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stops to send CSI report to the source cell.

Table A.6.3.1.12.2-1: Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
4	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
5	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
7	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
8	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
9	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.1.12.2-2: General test parameters for inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1

<table>
<tr><th colspan="2">Parameter</th><th>Unit</th><th>Value</th><th>Comment</th></tr>
<tr><td rowspan="2">Initial conditions</td><td>Active cell</td><td></td><td>Cell 1</td><td></td></tr>
<tr><td>Neighbouring cell</td><td></td><td>Cell 2</td><td></td></tr>
<tr><td>Final condition</td><td>Active cell</td><td></td><td>Cell 2</td><td></td></tr>
<tr><td colspan="2">A3-Offset</td><td>dB</td><td>-4</td><td></td></tr>
<tr><td colspan="2">Hysteresis</td><td>dB</td><td>0</td><td></td></tr>
<tr><td colspan="2">Time To Trigger</td><td>s</td><td>0</td><td></td></tr>
<tr><td colspan="2">Filter coefficient</td><td></td><td>0</td><td>L3 filtering is not used</td></tr>
<tr><td colspan="2">Access Barring Information</td><td>-</td><td>Not Sent</td><td>No additional delays in random access procedure.</td></tr>
<tr><td rowspan="2">Time offset between cells</td><td>Config 1,2,4,5</td><td>ms</td><td>0.5</td><td rowspan="2">Asynchronous cells</td></tr>
<tr><td>Config3,6,7,8,9</td><td>ms</td><td>0.25</td></tr>
<tr><td colspan="2">DRX</td><td></td><td>OFF</td><td></td></tr>
<tr><td colspan="2">Measurement gap pattern Id</td><td></td><td>#0</td><td>Gaps are configured before T2.</td></tr>
<tr><td colspan="2">T1</td><td>s</td><td>5</td><td></td></tr>
<tr><td colspan="2">T2</td><td>s</td><td><5</td><td></td></tr>
<tr><td colspan="2">T3</td><td>s</td><td><0.5</td><td></td></tr>
<tr><td colspan="2">T4</td><td>ms</td><td>10+$T_{interrupt2}$</td><td>$T_{interrupt2}$ as defined in Table 6.1.3.2.2-6 for asynchronous DAPS HO.</td></tr>
<tr><td colspan="2">T5</td><td>ms</td><td>100</td><td></td></tr>
</table>

Table A.6.3.1.12.2-3: Cell specific test parameters for inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1 (Cell 1)

Parameter		Unit	Cell 1				
			T1	T2	T3	T4	T5
NR RF Channel Number			1				
Duplex mode	Config 1,4,7		FDD				
	Config 2,3,5,6,8,9		TDD				
TDD configuration	Config 1,4,7		Not Applicable				
	Config 2,5,8		TDDConf.1.1				
	Config 3,6,9		TDDConf.2.1				
$BW_{channel}$	Config 1,4,7	MHz	10: $N_{RB,c}$ = 52				
	Config 2,5,8		10: $N_{RB,c}$ = 52				
	Config 3,6,9		40: $N_{RB,c}$ = 106				
BWP BW	Config 1,4,7	MHz	10: $N_{RB,c}$ = 52				
	Config 2,5,8		10: $N_{RB,c}$ = 52				
	Config 3,6,9		40: $N_{RB,c}$ = 106				
TRS configuration	Config 1,4,7		TRS.1.1 FDD				
	Config 2,5,8		TRS.1.1 TDD				
	Config 3,6,9		TRS.1.2 TDD				
DRX Cycle		ms	Not Applicable				
PDSCH Reference measurement channel	Config 1,4,7		SR.1.1 FDD				
	Config 2,5,8		SR.1.1 TDD				
	Config 3,6,9		SR2.1 TDD				
CORESET Reference Channel	Config 1,4,7		CR.1.1 FDD				
	Config 2,5,8		CR.1.1 TDD				
	Config 3,6,9		CR2.1 TDD				
OCNG Patterns			OCNG pattern 1				
SMTC Configuration			SMTC pattern 1				
SSB Configuration	Config 1,2,4,5,7,8		SSB.1 FR1				
	Config 3,6,9		SSB.2 FR1				
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz				
	Config 3,6,9		30 kHz				
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5,7,8	kHz	15 kHz				
	Config 3,6,9		30 kHz				
PRACH configuration			FR1 PRACH configuration 2				
BWP	Initial DL BWP		DLBWP.0.1				
	Dedicated DL BWP		DLBWP.1.3				
	Initial UL BWP		ULBWP.0.1				
	Dedicated UL BWP		ULBWP.1.3				
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15kHz	-98	-98	-98	-98	-98
N_{oc} Note2	Config 1,2,4,5,7,8	dBm/SCS	-98	-98	-98	-98	-98
	Config 3,6,9		-95	-95	-95	-95	-95
$\hat{E}_s/I_{ot}$		dB	4	4	4	4	4

$\hat{E}_s/N_{oc}$		dB	4	4	4	4	4
SSB_RP	Config 1,2,4,5,7,8	dBm/SCS	-94	-94	-94	-94	-94
	Config 3,6,9	dBm/SCS	-91	-91	-91	-91	-91
Io[Note3]	Config 1,2,4,5,7,8	dBm/ 9.36MHz	-64.59	-64.59	-64.59	-64.59	-64.59
	Config 3,6,9	dBm/ 38.16MHz	-58.49	-58.49	-58.49	-58.49	-58.49
Propagation condition		-	AWGN				
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

Table A.6.3.1.12.2-4: Cell specific test parameters for inter-band inter-frequency asynchronous DAPS handover from FR1 to FR1 (Cell 2)

Parameter	Unit	Cell 2				
		T1	T2	T3	T4	T5

NR RF Channel Number			2				
Duplex mode	Config 1,2,3		FDD				
	Config 4,5,6,7,8,9		TDD				
TDD configuration	Config 1,2,3		Not Applicable				
	Config 4,5,6		TDDConf.1.1				
	Config 7,8,9		TDDConf.2.1				
$BW_{channel}$	Config 1,2,3	MHz	10: $N_{RB,c}$ = 52				
	Config 4,5,6		10: $N_{RB,c}$ = 52				
	Config 7,8,9		40: $N_{RB,c}$ = 106				
BWP BW	Config 1,2,3	MHz	10: $N_{RB,c}$ = 52				
	Config 4,5,6		10: $N_{RB,c}$ = 52				
	Config 7,8,9		40: $N_{RB,c}$ = 106				
TRS configuration	Config 1,2,3		TRS.1.1 FDD				
	Config 4,5,6		TRS.1.1 TDD				
	Config 7,8,9		TRS.1.2 TDD				
DRx Cycle		ms	Not Applicable				
PDSCH Reference measurement channel	Config 1,2,3		SR.1.1 FDD				
	Config 4,5,6		SR.1.1 TDD				
	Config 7,8,9		SR2.1 TDD				
CORESET Reference Channel	Config 1,2,3		CR.1.1 FDD				
	Config 4,5,6		CR.1.1 TDD				
	Config 7,8,9		CR2.1 TDD				
OCNG Patterns			OCNG pattern 1				
SMTC Configuration			SMTC pattern 1				
SSB Configuration	Config 1,2,3,4,5,6		SSB.1 FR1				
	Config 7,8,9		SSB.2 FR1				
PDSCH/PDCCH subcarrier spacing	Config 1,2,3,4,5,6	kHz	15 kHz				
	Config 7,8,9		30 kHz				
PUCCH/PUSCH subcarrier spacing	Config 1,2,3,4,5,6	kHz	15 kHz				
	Config 7,8,9		30 kHz				
PRACH configuration			FR1 PRACH configuration 2				
BWP	Initial DL BWP		DLBWP.0.1				
	Dedicated DL BWP		DLBWP.1.3				
	Initial UL BWP		ULBWP.0.1				
	Dedicated UL BWP		ULBWP.1.3				
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15kHz	-98	-98	-98	-98	-98
N_{oc} Note2	Config 1,2,3,4,5,6	dBm/SCS	-98	-98	-98	-98	-98
	Config 7,8,9		-95	-95	-95	-95	-95
$\hat{E}_s/I_{ot}$		dB	-Infinity	4	4	4	4
$\hat{E}_s/N_{oc}$		dB	-Infinity	4	4	4	4
SSB_RP	Config 1,2,3,4,5,6	dBm/SCS	-Infinity	-94	-94	-94	-94

	Config 7,8,9	dBm/SCS	-Infinity	-91	-91	-91	-91
Io Note3	Config 1,2,3,4,5,6	dBm/ 9.36MHz	-70.05	-64.59	-64.59	-64.59	-64.59
	Config 7,8,9	dBm/ 38.16MHz	-63.94	-58.49	-58.49	-58.49	-58.49
Propagation condition		-	AWGN				
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.							

A.6.3.1.12.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 72 ms from the beginning of time period T3. During $D_{handover1}$, the interruption on Cell 1 shall not exceed $T_{interrupt1}$ as defined in Table 6.1.3.2.2-3 for asynchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay $D_{handover1}$ can be expressed as: $T_{RRC\_procedure} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 20 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 72 ms.

The UE shall complete to release Cell 1 less than (10 ms + $T_{interrupt2}$) from the beginning of time period T4. During $D_{handover2}$, the interruption on Cell 2 shall not exceed $T_{interrupt2}$ as defined in Table 6.1.3.2.2-6 for asynchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay $D_{handover2}$ can be expressed as: $T_{RRC\_procedure} + T_{interrupt2}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

A.6.3.2 RRC Connection Mobility Control

A.6.3.2.1 SA: RRC Re-establishment

A.6.3.2.1.1 Intra-frequency RRC Re-establishment in FR1

A.6.3.2.1.1.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR1 with known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.6.3.2.1.1.1-1, table A.6.3.2.1.1.1-2 and table A.6.3.2.1.1.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period

T2, cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.6.3.2.1.1.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.3.2.1.1.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell1	
	Neighbour cells		1, 2, 3	Cell2	
Final condition	Active cell		1, 2, 3	Cell2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
N310		-	1, 2, 3	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3	0	Radio link failure timer; T310 is disabled
T311		ms	1, 2, 3	3000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	OFF	
PRACH configuration			1, 2, 3	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3	5	
T2		ms	1, 2, 3	200	Time for the UE to detect RLF
T3		s	1, 2, 3	2	

Table A.6.3.2.1.1.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			N/A		
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
TRS configuration		1	TRS.1.1 FDD			N/A		
		2	TRS.1.1 TDD					
		3	TRS.1.2 TDD					
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
Active DL BWP confgiuration		1, 2, 3	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		1, 2, 3	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	1.54	-infinity	-infinity	-3.79	4	4
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	7	-infinity	-infinity	4	4	4
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-91	-infinity	-infinity	-94	-94	-94
		2	-91	-infinity	-infinity	-94	-94	-94
		3	-88	-infinity	-infinity	-91	-91	-91
Io	dBm/9.36 MHz	1	-60.74	-64.59	-64.59	-60.74	-64.59	-64.59
	dBm/9.36 MHz	2	-60.74	-64.59	-64.59	-60.74	-64.59	-64.59
	dBm/38.16 MHz	3	-54.65	-58.50	-58.50	-54.65	-58.50	-58.50
Propagation Condition		1, 2, 3	AWGN					

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.2.1.1.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to a known NR intra frequency cell shall be less than 1.6 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90%.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish\_delay} = T_{UL\_grant} + T_{UE\_re\text{-}establish\_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE\_re-establish\_delay} = 50\text{ ms} + T_{identify\_intra\_NR} + \sum_{i=1}^{Nfreq-1} T_{identify\_inter\_NR,i} + T_{SI-NR} + T_{PRACH}$$

N_{freq} = 1

$T_{identify\_intra\_NR}$ = 200 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 1545 ms, allow 1.6 s in the test case.

A.6.3.2.1.2 Inter-frequency RRC Re-establishment in FR1

A.6.3.2.1.2.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay in FR1 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.6.3.2.1.2.1-1, table A.6.3.2.1.2.1-2 and table A.6.3.2.1.2.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of cell 2 by the end of T1.

Table A.6.3.2.1.2.1-1: Supported test configurations

Configuration	Description of serving cell	Description of target cell
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.6.3.2.1.2.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell1	
	Neighbour cells		1, 2, 3	Cell2	
Final condition	Active cell		1, 2, 3	Cell2	
RF Channel Number			1, 2, 3	1, 2	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
N310		-	1, 2, 3	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3	0	Radio link failure timer; T310 is disabled
T311		ms	1, 2, 3	5000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	OFF	
PRACH configuration			1, 2, 3	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3	5	
T2		ms	1, 2, 3	200	Time for the UE to detect RLF
T3		s	1, 2, 3	5	

Table A.6.3.2.1.2.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
RF Channel Number		1, 2, 3	1			2		
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			N/A		
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
TRS configuration		1	TRS.1.1 FDD			N/A		
		2	TRS.1.1 TDD					
		3	TRS.1.2 TDD					
Initial DL BWP configuration		1, 2, 3	DLBWP.0			DLBWP.0		
Initial UL BWP configuration		1, 2, 3	ULBWP.0			ULBWP.0		
Active DL BWP confgiuration		1, 2, 3	DLBWP.1.1	N/A	N/A	N/A	N/A	DLBWP.1.1
Active UL BWP configuration		1, 2, 3	ULBWP.1.1	N/A	N/A	N/A	N/A	ULBWP.1.1
RLM-RS		1, 2, 3	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	7
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-94	-infinity	-infinity	-infinity	-infinity	-91
		2	-94	-infinity	-infinity	-infinity	-infinity	-91
		3	-91	-infinity	-infinity	-infinity	-infinity	-88
Io	dBm/9.36 MHz	1	-64.59	-70. 05	-70. 05	-70. 05	-70. 05	-62.26
	dBm/9.36 MHz	2	-64.59	-70. 05	-70. 05	-70. 05	-70.05	-62.26
	dBm/38.16 MHz	3	-58.50	-63.94	-63.94	-63.94	-63.94	-56.15
Propagation Condition		1, 2, 3	AWGN					

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.2.1.2.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR inter frequency cell shall be less than 3 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90%.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish\_delay} = T_{UL\_grant} + T_{UE\_re\text{-}establish\_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE\_re-establish\_delay} = 50\ ms + T_{identify\_intra\_NR} + \sum_{i=1}^{Nfreq-1} T_{identify\_inter\_NR,i} + T_{SI-NR} + T_{PRACH}$$

N_{freq} = 2

$T_{identify\_intra\_NR}$ = 800 ms

$T_{identify\_inter\_NR}$ = 800 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 2945 ms, allow 3 s in the test case.

A.6.3.2.1.3 Intra-frequency RRC Re-establishment in FR1 without serving cell timing

A.6.3.2.1.3.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR1 without serving cell timing is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.6.3.2.1.3.1-1, table A.6.3.2.1.3.1-2 and table A.6.3.2.1.3.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.6.3.2.1.3.1-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.3.2.1.3.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3	Cell1	
	Neighbour cells		1, 2, 3	Cell2	
Final condition	Active cell		1, 2, 3	Cell2	
RF Channel Number			1, 2, 3	1	
Time offset between cells			1	3 ms	Asynchronous cells
			2	3 μs	Synchronous cells
			3	3 μs	Synchronous cells
N310		-	1, 2, 3	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1, 2, 3	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1, 2, 3	6000	Radio link failure timer configured by *RLF-TimersAndConstants*
T311		ms	1, 2, 3	3000	RRC re-establishment timer
Access Barring Information		-	1, 2, 3	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR1	
			2	SSB.1 FR1	
			3	SSB.2 FR1	
SMTC configuration			1	SMTC pattern 2	
			2	SMTC pattern 1	
			3	SMTC pattern 1	
DRX cycle length		s	1, 2, 3	OFF	
PRACH configuration			1, 2, 3	FR1 PRACH configuration 1	Table A.3.8.2.1-1
T1		s	1, 2, 3	5	
T2		s	1, 2, 3	6	Time for the UE to detect RLF
T3		s	1, 2, 3	3	

Table A.6.3.2.1.3.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR1

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1	N/A			N/A		
		2	TDDConf.1.1			TDDConf.1.1		
		3	TDDConf.2.1			TDDConf.2.1		
PDSCH RMC configuration		1	SR.1.1 FDD			N/A		
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
RMSI CORESET RMC configuration		1	CR.1.1 FDD			CR.1.1 FDD		
		2	CR.1.1 TDD			CR.1.1 TDD		
		3	CR.2.1 TDD			CR.2.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD			CCR.1.1 FDD		
		2	CCR.1.1 TDD			CCR.1.1 TDD		
		3	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern		1, 2, 3	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2, 3	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2, 3	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	4
		2						
		3						
N_{oc} Note2	dBm/SCS	1	-98					
		2	-98					
		3	-95					
N_{oc} Note2	dBm/15 kHz	1	-98					
		2						
		3						
$\hat{E}_s/N_{oc}$	dB	1	4	-infinity	-infinity	-infinity	-infinity	4
		2						
		3						
SS-RSRP Note3	dBm/SCS	1	-94	-infinity	-infinity	-infinity	-infinity	-94
		2	-94	-infinity	-infinity	-infinity	-infinity	-94
		3	-91	-infinity	-infinity	-infinity	-infinity	-91
Io	dBm/9.36 MHz	1	-64.59	-infinity	-infinity	-infinity	-infinity	-64.59
	dBm/9.36 MHz	2	-64.59	-infinity	-infinity	-infinity	-infinity	-64.59
	dBm/38.16 MHz	3	-58.50	-infinity	-infinity	-infinity	-infinity	-58.50
Propagation Condition		1, 2, 3	AWGN					

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.3.2.1.3.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell without serving cell timing shall be less than 2.2 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90%.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish\_delay} = T_{UL\_grant} + T_{UE\_re\text{-}establish\_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE\_re-establish\_delay} = 50 \text{ ms} + T_{identify\_intra\_NR} + \sum_{i=1}^{Nfreq-1} T_{identify\_inter\_NR,i} + T_{SI-NR} + T_{PRACH}$$

N_{freq} = 1

$T_{identify\_intra\_NR}$ = 800 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 2145 ms, allow 2.2 s in the test case.

A.6.3.2.2 Random Access

A.6.3.2.2.1 4-step RA type contention based random access test in FR1 for NR standalone

A.6.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in Table A.6.3.2.2.1.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in Table A.6.3.2.2.1.1-2.

Table A.6.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.6.3.2.2.1.1-2: General test parameters for contention based random access test in FR1 for NR Standalone

Parameter			Unit	Test-1	Comments
SSB Configuration	Config 1			SSB pattern 1 in FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 2			SSB pattern 2 in FR1	
Number of SSBs per SS-burst				2	Different from the definition in A.3.10
SS/PBCH block index				0,1	Different from the definition in A.3.10
Duplex Mode for Cell 2	Config 1			FDD	
	Config 2			TDD	
TDD Configuration	Config 2			TDDConf.1.2	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 4	Config 1			SR.1.1 FDD	As defined in A.3.1.1.
	Config 2			SR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	
		Config 2		-101	
	$\hat{E}_s/N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	
		Config 2		-101	
	$\hat{E}_s/N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2	Config 1		dBm	-65.3/9.36MHz	For symbols without SSB index 1
	Config 2			-62.2/38.16MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
PRACH Configuration				FR1 PRACH configuration 1	As defined in A.3.8.
Propagation Condition			-	AWGN	

Note 1:	OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2:	SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
Note 3:	Void
Note 4:	The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.6.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.6.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in Clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB.*

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.6.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in Clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A.4.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in Clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.6.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in Clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.6.3.2.2.2 4-step RA type non-Contention based random access test in FR1 for NR standalone

A.6.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in Table A.6.3.2.2.2.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in Table A.6.3.2.2.2.1-2 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.6.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.6.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter			Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1			SSB pattern 1 in FR1	SSB pattern 1 in FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
	Config 2			SSB pattern 2 in FR1	SSB pattern 2 in FR1	
Number of SSBs per SS-burst				2	2	Different from the definition in A.3.10
SS/PBCH block index				0,1	0,1	Different from the definition in A.3.10
CSI-RS Configuration	Config 1			N/A	CSI-RS.1.1 FDD	As defined in A.3.1.4
	Config 2				CSI-RS.2.1 TDD	
Duplex Mode for Cell 2	Config 1			FDD	FDD	
	Config 2			TDD	TDD	
TDD Configuration	Config 2			TDDConf.1.2	TDDConf.1.2	
OCNG Pattern Note 1				OCNG pattern 1	OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 4	Config 1			SR.1.1 FDD	SR.1.1 FDD	As defined in A.3.1.1.
	Config 2			SR.2.1 TDD	SR.2.1 TDD	
NR RF Channel Number				1	1	
EPRE ratio of PSS to SSS			dB	0	0	
EPRE ratio of PBCH_DMRS to SSS			dB			
EPRE ratio of PBCH to PBCH_DMRS			dB			
EPRE ratio of PDCCH_DMRS to SSS			dB			
EPRE ratio of PDCCH to PDCCH_DMRS			dB			
EPRE ratio of PDSCH_DMRS to SSS			dB			
EPRE ratio of PDSCH to PDSCH_DMRS			dB			
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	3	3	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	-98	
		Config 2		-101	-101	
	$\hat{E}_s/N_{oc}$		dB	3	3	
	SS-RSRP Note 3		dBm/ SCS	-95	-95	
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-17	-17	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	-98	
		Config 2		-101	-101	
	$\hat{E}_s/N_{oc}$		dB	-17	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	-115	
Io Note 2	Config 1		dBm	-65.3/9.36MHz	-65.3/9.36MHz	For symbols without SSB index 1
	Config 2			-62.2/38.16MHz	-62.2/38.16MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	23	As defined in clause 6.2.4 in TS 38.101-1.

PRACH Configuration		FR1 PRACH configuration 2	FR1 PRACH configuration 3	As defined in A.3.8.2.
Propagation Condition	-	AWGN	AWGN	
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel. Note 2: SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters. Note 3: Void Note 4: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.				

A.6.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.6.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-2, to test the UE behavior specified in Clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the

System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.3 2-step RA type contention based random access test in FR1 for NR standalone

A.6.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the 2-step RA type random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.3 and Clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in Table A.6.3.2.2.3.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in Table A.6.3.2.2.3.1-2.

Table A.6.3.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.6.3.2.2.3.1-2: General test parameters for 2-step RA type contention based random access with successRAR test in FR1 for NR standalone

Parameter			Unit	Test-1	Comments
SSB Configuration		Config 1		SSB pattern 1 in FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
		Config 2		SSB pattern 2 in FR1	
Number of SSBs per SS-burst				2	Different from the definition in A.3.10
SS/PBCH block index				0,1	Different from the definition in A.3.10
Duplex Mode for Cell 2		Config 1		FDD	
		Config 2		TDD	
TDD Configuration		Config 2		TDDConf.1.2	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 3		Config 1		SR.1.1 FDD	As defined in A.3.1.1.
		Config 2		SR.2.1 TDD	
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	
		Config 2		-101	
	$\hat{E}_s/N_{oc}$		dB	3	
	SS-RSRP		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-98	
		Config 2		-101	
	$\hat{E}_s/N_{oc}$		dB	-17	
	SS-RSRP		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-65.3/9.36MHz	For symbols without SSB index 1
		Config 2		-62.2/38.16MHz	
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{CMAX,\ f,c}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 1	As defined in A.3.20.2.1.
msgA-RSRP-ThresholdSSB			dBm	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
Propagation Condition			-	AWGN	

Note 1:	OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2:	SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
Note 3:	The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.6.3.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.6.3.2.2.3.2.1 MsgA Transmission

To test the UE behavior specified in Clause 6.2.2.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA preamble transmission shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.3.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit an ACK if the MsgB with a successRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble and if the Contention Resolution is successful.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB(s) contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.3.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access

Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.4 2-step RA type SSB based non-contention based test in FR1 for NR standalone

A.6.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.3 and Clause 7.1.2 in an AWGN model.

For this test one cell is used and configured as PCell in FR1. Supported test parameters are shown in Table A.6.3.2.2.4.1-1. UE capable of SA with PCell in FR1 needs to be tested by using the parameters in Table A.6.3.2.2.4.1-2.

Table A.6.3.2.2.4.1-1: Supported test configurations for non-contention based random access test in FR1 for NR standalone

Config	Description
1	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations depending on UE capability	

Table A.6.3.2.2.4.1-2: General test parameters for non-contention based random access test in FR1 for NR Standalone

Parameter			Unit	Test-1	Comments
SSB Configuration		Config 1		SSB pattern 2 in FR1	As defined in A.3.10, except for number of SSBs per SS-burst and SS/PBCH block index as below
Number of SSBs per SS-burst				2	Different from the definition in A.3.10
SS/PBCH block index				0,1	Different from the definition in A.3.10
Duplex Mode for Cell 1		Config 1		TDD	
TDD Configuration		Config 1		TDDConf.1.2	
OCNG Pattern Note 1				OCNG pattern 1	As defined in A.3.2.1.
PDSCH parameters Note 4		Config 1		SR.2.1 TDD	As defined in A.3.1.1.
NR RF Channel Number				1	
EPRE ratio of PSS to SSS			dB	0	
EPRE ratio of PBCH_DMRS to SSS			dB		
EPRE ratio of PBCH to PBCH_DMRS			dB		
EPRE ratio of PDCCH_DMRS to SSS			dB		
EPRE ratio of PDCCH to PDCCH_DMRS			dB		
EPRE ratio of PDSCH_DMRS to SSS			dB		
EPRE ratio of PDSCH to PDSCH_DMRS			dB		
msgA-*RSRP-ThresholdSSB*			dBm	RSRP_51	The actual value of the threshold is -105dBm, as defined in TS 38.331 [2].
SSB with index 0	$\hat{E}_s/I_{ot}$		dB	3	Power of SSB with index 0 is set to be above configured msgA-*RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-101	
	$\hat{E}_s/N_{oc}$		dB	3	
	SS-RSRP Note 3		dBm/ SCS	-95	
SSB with index 1	$\hat{E}_s/I_{ot}$		dB	-17	Power of SSB with index 1 is set to be below configured msgA-*RSRP-ThresholdSSB*
	N_{oc}	Config 1	dBm/15kHz	-101	
	$\hat{E}_s/N_{oc}$		dB	-17	
	SS-RSRP Note 3		dBm/ SCS	-115	
Io Note 2		Config 1	dBm	-62.2/38.16MHz	For symbols without SSB index 1
ss-PBCH-BlockPower			dBm/ SCS	-5	As defined in clause 6.3.2 in TS 38.331 [2].
Configured UE transmitted power ($P_{\text{CMAX, f, c}}$)			dBm	23	As defined in clause 6.2.4 in TS 38.101-1.
MsgA Configuration				FR1 MsgA configuration 2	As defined in A.3.20.2.2.
Propagation Condition			-	AWGN	

Note 1:	OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.
Note 2:	SS-RSRP, Es/Iot and Io levels have been derived from other parameters for information purpose. They are not settable parameters.
Note 3:	The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

A.6.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.6.3.2.2.4.2.1 MsgA Transmission

To test the UE behavior specified in Clause 6.2.2.3.2.1, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA PRACH on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a fallbackRAR containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. In response to the first 4 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 containing the payload of MsgA PUSCH if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble. The UE shall monitor contention resolution as described in clause 8.2A in TS 38.213 [3].

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA and msg3 transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB containing a successRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 5 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 4 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be -30 dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-1 [18], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-1 [18].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.6.3.2.3 SA: RRC Connection Release with Redirection

A.6.3.2.3.1 Redirection from NR in FR1 to NR in FR1

A.6.3.2.3.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to NR requirements specified in clause 6.2.3.2.1.

A.6.3.2.3.1.2 Test Parameters

Supported test configurations are shown in table A.6.3.2.3.1.2-1. The time delay is tested by using the parameters in table A.6.3.2.3.1.2-2, and A.6.3.2.3.1.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.6.3.2.3.1.2-1: Redirection from NR to NR test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.2.3.1.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	2.3	

Table A.6.3.2.3.1.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC configuration	Config 1,2		SMTC.1 FR1			
	Config 3		SMTC.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s/I_{ot}$		dB	4	4	-infinity	4
$\hat{E}_s/N_{oc}$		dB	4	4	-infinity	4
Io Note3	Config 1,2	dBm/ 9.36MHz	-64.59	-64.59	-70.05	-64.59

	Config 3	dBm/ 38.16MHz	-58.49	-58.49	-63.94	-58.49
Propagation condition		-	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.						
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.3.2.3.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2240 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90%.

NOTE: The redirection delay can be expressed as:

$$T_{connection\_release\_redirect\_NR} = T_{RRC\_procedure\_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH},$$

where:

$T_{RRC\_procedure\_delay}$ = 110 msin the test.

$T_{identify\text{-}NR}$ = 680 ms in the test.

$T_{SI\text{-}NR}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH} = 170 ms in the test.

This gives a total of 2240 ms.

A.6.3.2.3.2 Redirection from NR in FR1 to E-UTRAN

A.6.3.2.3.2.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to E-UTRAN requirements specified in clause 6.2.3.2.2.

A.6.3.2.3.2.2 Test Parameters

Supported test configurations are shown in table A.6.3.2.3.2.2-1. The time delay is tested by using the parameters in table A.6.3.2.3.2.2-2, A.6.3.2.3.2.2-3 and A.6.3.2.3.2.2-4.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.6.3.2.3.2.2-1: Redirection from NR to E-UTRAN test configurations

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.2.3.2.2-2: General test parameters for Redirection from NR to E-UTRAN test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	2.3	

Table A.6.3.2.3.2.2-3: Cell specific test parameters for Redirection from NR to E-UTRAN (cell 1)

Parameter		Unit	Cell 1	
			T1	T2
RF Channel Number			1	
Duplex mode	Config 1,4		FDD	
	Config 2,3,5,6		TDD	
TDD configuration	Config 1,4		Not Applicable	
	Config 2,5		TDDConf.1.1	
	Config 3,6		TDDConf.2.1	
$BW_{channel}$	Config 1,4	MHz	10: $N_{RB,c}$ = 52	
	Config 2,5		10: $N_{RB,c}$ = 52	
	Config 3,6		40: $N_{RB,c}$ = 106	
BWP BW	Config 1,4	MHz	10: $N_{RB,c}$ = 52	
	Config 2,5		10: $N_{RB,c}$ = 52	
	Config 3,6		40: $N_{RB,c}$ = 106	
DRx Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	
	Config 2,5		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD	
CORESET Reference Channel	Config 1,4		CR.1.1 FDD	
	Config 2,5		CR.1.1 TDD	
	Config 3,6		CR2.1 TDD	
OCNG Patterns			OCNG pattern 1	
SMTC configuration	Config 1,2,4,5		SMTC.1 FR1	
	Config 3,6		SMTC.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	
	Config 3,6		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2,4,5	kHz	15 kHz	
	Config 3,6		30 kHz	
PRACH configuration			FR1 PRACH configuration 1	
BWP configuration	Initial DL BWP		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	
N_{oc} Note2	Config 1,2,4,5	dBm/SCS	-98	
	Config 3,6		-95	
$\hat{E}_s/I_{ot}$		dB	4	4
$\hat{E}_s/N_{oc}$		dB	4	4
Io Note3	Config 1,2,4,5	dBm/9.36MHz	-64.59	-64.59

	Config 3,6	dBm/ 38.16MHz	-58.49	-58.49
Propagation condition		-	AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

Table A.6.3.2.3.2.2-4: Cell specific test parameters for Redirection from NR to E-UTRAN (cell 2)

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PRACH Configuration[Note2]		1, 2, 3	4	
		4, 5, 6	53	
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note4]				
OCNG_RB[Note4]				
N_{oc}[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	4
$\hat{E}_s/I_{ot}$[Note6]	dB	1, 2, 3, 4, 5, 6	-Infinity	4
RSRP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-94
SCH_RP[Note6]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-94
Io[Note6]	dBm/9MHz	1, 2, 3, 4, 5, 6	-70.22	-64.76
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN	

Note 1:	Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2:	PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
Note 3:	DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 4:	OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 5:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 6:	$\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 7:	Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.6.3.2.3.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 2205 ms from the beginning of time period T2.
The rate of correct RRC connection release redirection to E-UTRAN observed during repeated tests shall be at least 90%.

NOTE: The redirection delay can be expressed as:

$$T_{connection\_release\_redirect\_E\text{-}UTRA} = T_{RRC\_procedure\_delay} + T_{identify\text{-}E\text{-}UTRA} + T_{SI\text{-}E\text{-}UTRA} + T_{RACH},$$

where:

$T_{RRC\_procedure\_delay}$ = 110 ms in the test.

$T_{identify\text{-}E\text{-}UTRA}$ = 800 ms in the test.

$T_{SI\text{-}E\text{-}UTRA}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 36.331 for the target E-UTRA cell.

T_{RACH} = 15 ms in the test.

This gives a total of 2205 ms.

A.6.3.3 Conditional handover

A.6.3.3.1 Intra-frequency conditional handover from FR1 to FR1

A.6.3.3.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR1 intra frequency conditional handover requirements specified in clause 6.1.4.2.

A.6.3.3.1.2 Test Parameters

Supported test configurations are shown in table A.6.3.3.1.2-1. Both conditional handover delay and interruption length are tested by using the parameters in table A.6.3.3.1.2-2, and A.6.3.3.1.2-3.

The test consists of two successive time periods, with time durations of T1 and T2 respectively. At the start of time duration T1, the UE may not have any timing information of cell 2.

NR shall configure a condition implying handover to cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2.

Table A.6.3.3.1.2-1: Intra-frequency conditional handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.3.1.2-2: General test parameters Intra-frequency conditional handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset in condition		dB	0	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
PRACH configuration index			FR1 PRACH configuration 1	As specified in table Table 6.3.3.2-3 in TS 38.211 [6]
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤2	

Table A.6.3.3.1.2-3: Cell specific test parameters for NR FR1-FR1 Intra frequency conditional handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98			
N_{oc} Note2	Config 1,2	dBm/SCS	-98			
	Config 3		-95			
$\hat{E}_s/I_{ot}$		dB	8	-3.3	-Infinity	2.36
$\hat{E}_s/N_{oc}$		dB	8	8	-Infinity	11

SSB_RP	Config 1,2	dBm/SCS	-90	-90	- Infinity	-87
	Config 3	dBm/SCS	-87	-87	- Infinity	-84
Io[Note3]	Config 1,2	dBm/ 9.36MHz	-61.41	-57.06	-61.41	-57.06
	Config 3	dBm/ 38.16MHz	-55.31	-50.96	-55.31	-50.96
Propagation condition		-	AWGN			AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.3.3.1.3 Test Requirements

T_{RRC} + T_{Event_DU} occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{interrupt}$ + $T_{CHO\_execution}$ = 800 +62 +10=872ms from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}$=$T_{processing}$ + T_{IU} + T_{Δ} + T_{margin} =40+20+2 = 62ms

A.6.3.3.2 Inter-frequency conditional handover from FR1 to FR1

A.6.3.3.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR conditional FR1-NR FR1 inter frequency conditional handover requirements specified in clause 6.1.4.2.

A.6.3.3.2.2 Test Parameters

Supported test configurations are shown in table A.6.3.3.2.2-1. Both conditional handover delay and interruption length are tested by using the parameters in table A.6.3.3.2.2-2, and A.6.3.3.2.2-3.

The test scenario comprises of two carriers and one cell on each carrier Gap pattern ID gp0 is configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. NR shall configure a condition implying handover to cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2. At the start of T2, cell 2 becomes detectable and meets the handover condition.

Table A.6.3.3.2.2-1: Inter-frequency handover from FR1 to FR1 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.3.3.2.2-2: General test parameters Inter-frequency handover from FR1 to FR1

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset in handover condition		dB	-4	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
T1		s	5	
T2		s	≤2	

Table A.6.3.3.2.2-3: Cell specific test parameters for NR FR1-FR1 Inter frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52			
	Config 2		10: $N_{RB,c}$ = 52			
	Config 3		40: $N_{RB,c}$ = 106			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
DRx Cycle		ms	Not Applicable			
Gap pattern ID			gp0			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD			
	Config 2		SR.1.1 TDD			
	Config 3		SR2.1 TDD			
CORESET Reference Channel	Config 1		CR.1.1 FDD			
	Config 2		CR.1.1 TDD			
	Config 3		CR2.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz			
	Config 3		30 kHz			
PRACH configuration			FR1 PRACH configuration 1			
BWP	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0			
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-98		-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98		-98	
	Config 3		-95		-95	

$\hat{E}_s/I_{ot}$		dB	4	4	-Infinity	5
$\hat{E}_s/N_{oc}$		dB	4	4	-Infinity	5
SSB_RP	Config 1,2	dBm/SCS	-94	-94	-Infinity	-93
	Config 3	dBm/SCS	-91	-91	-Infinity	-90
Io[Note3]	Config 1,2	dBm/ 9.36MHz	-64.59	-64.59	-70.05	-63.85
	Config 3	dBm/ 38.16MHz	-58.49	-58.49	-63.94	-57.75
Propagation condition		-	AWGN		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.3.3.2.3 Test Requirements

T_{RRC} + T_{Event_DU} occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{interrupt}$ + $T_{CHO\_execution}$ =920 +62 +10=992 ms from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}$=$T_{processing}$ + T_{IU} + T_{Δ} + T_{margin} =40+20+2 = 62ms excluding any transmissions which do not occur due to measurement gaps.

Inter-frequency CHO FR1-FR1 920 (Tmeasure)+62 (Tinterrupt)+10 (TCHO_execution) = 992 62 m

A.6.4 Timing

A.6.4.1 UE transmit timing

A.6.4.1.1 NR UE Transmit Timing Test for FR1

A.6.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in Table 6.4.1.1.1-1

Table A.6.4.1.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	NR TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	NR TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
Note: The UE is only required to be tested in one of the supported test configurations	

For this test a single NR cell is used. Table A.6.4.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.6.4.1.1.1-3.

Table A.6.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1,2,3	1	1
TDD configuration		1	Not Applicable	
		2	TDDConf.1.1	
		3	TDDConf.1.2	
$BW_{channel}$	MHz	1	10: $N_{RB,c}$ = 52	
		2	10: $N_{RB,c}$ = 52	
		3	40: $N_{RB,c}$ = 106	
Initial BWP Configuration		1,2,3	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1,2,3	DLBWP.1.1 ULBWP.1.1	
DRx Cycle	ms	1,2,3	N/A	DRX.8^Note5
PDSCH Reference measurement channel		1	SR.1.1 FDD	
		2	SR.1.1 TDD	
		3	SR.2.1 TDD	
RMSI CORESET Reference Channel		1	CR.1.1 FDD	
		2	CR.1.1 TDD	
		3	CR.2.1 TDD	
Dedicated CORESET Reference Channel		1	CCR.1.1 FDD	
		2	CCR.1.1 TDD	
		3	CCR.2.1 TDD	
OCNG Patterns		1,2,3	OP.1	
SSB configuration		1,2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC Configuration		1,2	SMTC.1	
		3	SMTC.2	
TRS configuration		1	TRS.1.1 FDD	
		2	TRS.1.1 TDD	
		3	TRS.1.2 TDD	
EPRE ratio of PSS to SSS	dB	1,2,3	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15 kHz	1,2,3	-98	-98
N_{oc} Note2	dBm/SCS	1,2	-98	-98
		3	-95	-95
$\hat{E}_s/I_{ot}$		1,2,3	3	3
$\hat{E}_s/N_{oc}$		1,2,3	3	3
SS-RSRP Note3	dBm/SCS	1,2	-95	-95

		3	-92	-92
Io[Note3]	dBm/9.36MHz	1,2	-65.2	-65.2
	dBm/38.1MHz	3	-59.2	-59.2
Propagation condition		1,2,3	AWGN	
SRS Config		1,2	SRSConf.1[Note6]	SRSConf.3[Note6]
		3	SRSConf.1[Note6]	SRSConf.2[Note6]
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: DRx related parameters are given in Table A.3.3.8-1 Note 6: SRS configs are given in Table A.6.4.1.1.1-3				

Table A.6.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	SRSConf.3	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	0	
	srs-ResourceIdList	0	0	0	
	resourceType	Periodic	Periodic	Periodic	
	Usage	Codebook	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	0	
	nrofSRS-Ports	Port1	Port1	Port1	
	transmissionComb	n2	n2	n2	
	combOffset-n2	0	0	0	
	cyclicShift-n2	0	0	0	
	resourceMapping startPosition	0	0	0	
	resourceMapping nrofSymbols	n1	n1	n1	
	resourceMapping repetitionFactor	n1	n1	n1	
	freqDomainPosition	0	0	0	
	freqDomainShift	0	0	0	
	freqHopping c-SRS	14 for test configuration 1,2 25 for test configuration 3	25	14	Matches $N_{RB,c}$
	freqHopping b-SRS	0	0	0	
	freqHopping b-hop	0	0	0	
	groupOrSequenceHopping	Neither	Neither	Neither	
	resourceType	Periodic	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl640, 0	sl320, 0	Offset to align with DRx periodicity
	sequenceId	0	0	0	Any 10 bit number

Table A.6.4.1.1.1-4: Void

A.6.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test

1) Setup NR PCell according to parameters given in Table A.6.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.

   a. The N_{TA} offset value (in T_c units) is 25600

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.6.4.1.1.2-1

Table A.6.4.1.1.2-1: Adjustment Value for DL Timing

SCS of SSB signals (KHz)	Adjustment Value	
	Test1	Test2
15	$+64*64T_c$	$+32*64T_c$
30	$+32*64T_c$	$+16*64T_c$

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment

A.6.4.2 UE timer accuracy

A.6.4.3 Timing advance

A.6.4.3.1 SA FR1 timing advance adjustment accuracy

A.6.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.6.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.6.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.6.4.3.1.2-2, A.6.4.3.1.2-3 and A.6.4.3.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.6.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in Clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to Clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.6.4.3.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.6.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in Table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in Table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in Table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in Table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA\_new} = N_{TA\_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	For 15 kHz SCS $N_{TA\_new} = N_{TA\_old} + 8192*T_c$ For 30 kHz SCS $N_{TA\_new} = N_{TA\_old} + 4096*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.6.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter		Unit	Test1	
			T1	T2
Duplex mode	Config 1		FDD	
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52	
	Config 2		10: $N_{RB,c}$ = 52	
	Config 3		40: $N_{RB,c}$ = 106	
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52	
	Config 2		10: $N_{RB,c}$ = 52	
	Config 3		40: $N_{RB,c}$ = 106	
DRx Cycle		ms	Not Applicable	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	
	Config 2		SR.1.1 TDD	
	Config 3		SR2.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR2.1 TDD	
TRS configuration	Config 1,4		TRS.1.1 FDD	
	Config 2,5		TRS.1.1 TDD	
	Config 3,6		TRS.1.2 TDD	
OCNG Patterns			OCNG pattern 1	
SMTC configuration	Config 1,2		SMTC.1 FR1	
	Config 3		SMTC.2 FR1	
SSB configuration	Config 1,2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz	
	Config 3		30 kHz	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2		dBm/15kHz	-98	
N_{oc} Note2	Config 1,2	dBm/SCS	-98	
	Config 3		-95	
$\hat{E}_s/I_{ot}$		dB	3	
$\hat{E}_s/N_{oc}$		dB	3	
Io Note3	Config 1,2	dBm/ 9.36MHz	-67.57	
	Config 3	dBm/ 38.16MHz	-62.58	

Propagation condition	-	AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.		

Table A.6.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field		Value	Comment
c-SRS	Config 1,2	12	Frequency hopping is disabled
	Config 3	24	
b-SRS		0	
b-hop		0	
freqDomainPosition		0	Frequency domain position of SRS
freqDomainShift		0	
groupOrSequenceHopping		neither	No group or sequence hopping
SRS-PeriodicityAndOffset		sl5=2 for SCS 15kHz sl5=4 for SCS 30kHz	Once every 5 slots
pathlossReferenceRS		ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage		Codebook	Codebook based UL transmission
startPosition		0	resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition.
nrofSymbols		n1	
repetitionFactor		n1	
combOffset-n2		0	transmissionComb setting
cyclicShift-n2		0	
nrofSRS-Ports		port1	Number of antenna ports used for SRS transmission
Note: For further information see clause 6.3.2 in TS 38.331 [2].			

A.6.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. *k+1* slots after the reception of the timing advance command, where k=5.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

A.6.5 Signalling characteristics

A.6.5.1 Radio link Monitoring

In the following clause, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

For intra-band contiguous carrier aggregation, transmit OFF power is measured as the mean power per component carrier.

For UE with multiple transmit antennas, transmit OFF power is measured as the mean power at each transmit connector.

- UE output power higher than Transmit OFF power -50 dBm (as defined in TS 38.101-1 [18]) means uplink signal

- UE output power equal to or less than Transmit OFF power -50 dBm (as defined in TS 38.101-1 [18]) means no uplink signal.

A.6.5.1.1 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode

A.6.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.6.5.1.1.1-1. The test parameters are given in Tables A.6.5.1.1.1-2, A.6.5.1.1.1-3, and A.6.5.1.1.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 1.

Table A.6.5.1.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.1.1-2: General test parameters for FR1 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52
	Config 2		10: $N_{RB,c}$ = 52
	Config 3		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*

T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.1.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1		
			T1	**T2**	**T3**
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
SNR on other channels and signals	Config 1, 2, 3	dB	1		
N_{oc}	Config 1	dBm/15kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition			TDL-C 300ns 100Hz		

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.6.5.1.1.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.

Table A.6.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0

Note: Ensure that RLM RS is partially overlapped with measurement gap

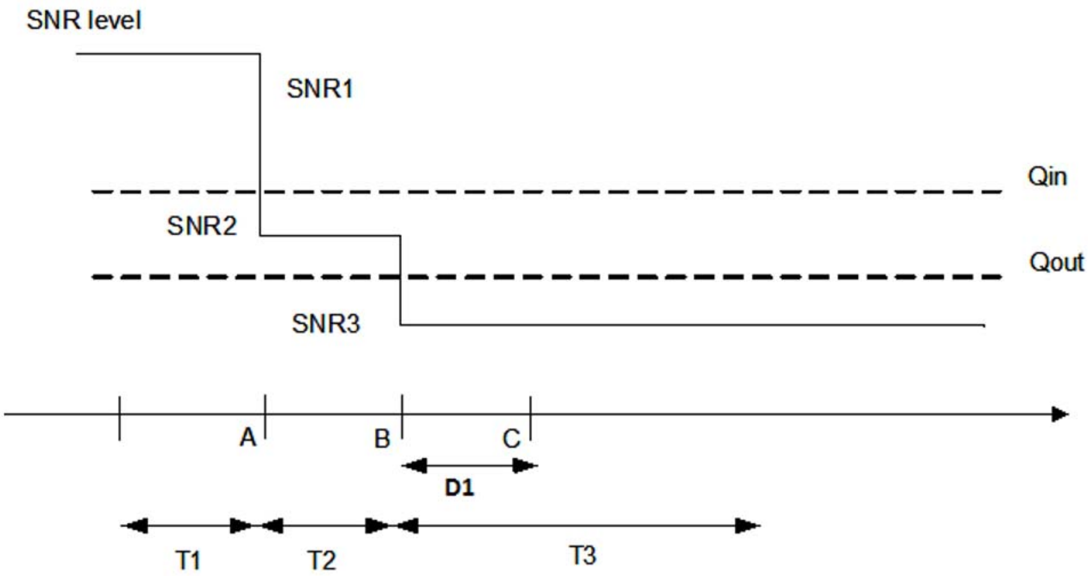


Figure A.6.5.1.1.1-1: SNR variation for out-of-sync testing

A.6.5.1.1.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.1.2 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in non-DRX mode

A.6.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.6.5.1.2.1-1. The test parameters are given in Tables A.6.5.1.2.1-2, and A.6.5.1.2.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.6.5.1.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.2.1-2: General test parameters for FR1 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52
	Config 2		10: $N_{RB,c}$ = 52
	Config 3		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6

Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1, 4		TRS.1.1 FDD
	Config 2, 5		TRS.1.1 TDD
	Config 3, 6		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.2.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	4				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
SNR on other channels and signals	Config 1, 2, 3	dB	1				
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	Config 1	dBm/SCS	-98				
	Config 2		-98				
	Config 3		-95				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.6.5.1.2.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.

Table A.6.5.1.2.1-4: Void

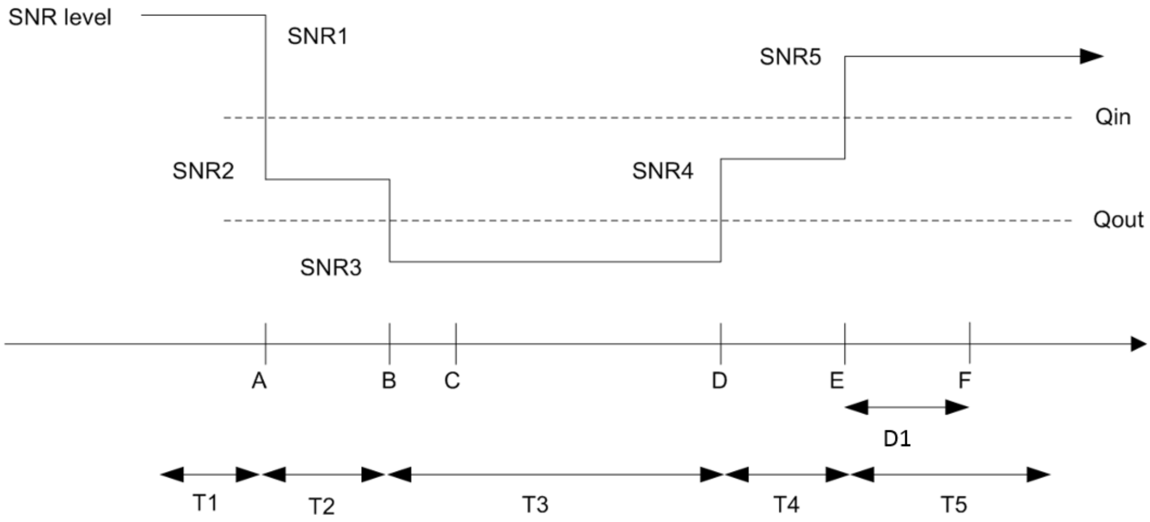


Figure A.6.5.1.2.1-1: SNR variation for in-sync testing

A.6.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.1.3 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode

A.6.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.6.5.1.3.1-1. The test parameters are given in Tables A.6.5.1.3.1-2, and A.6.5.1.3.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. The UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 2.

Table A.6.5.1.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.3.1-2: General test parameters for FR1 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52
	Config 2		10: $N_{RB,c}$ = 52
	Config 3		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4

	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.68
T3		s	0.68
D1		s	0.64
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.3.1-3: Cell specific test parameters for FR1 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
SNR on other channels and signals	Config 1, 2, 3	dB	1		
N_{oc}	Config 1	dBm/15 kHz	-98		
	Config 2		-98		
	Config 3		-98		
N_{oc}	Config 1	dBm/SCS	-98		
	Config 2		-98		
	Config 3		-95		
Propagation condition			TDL-C 300ns 100Hz		

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in Figure A.6.5.1.3.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.

Table A.6.5.1.3.1-4: Void

Table A.6.5.1.3.1-5: Void

Table A.6.5.1.3.1-6: Void

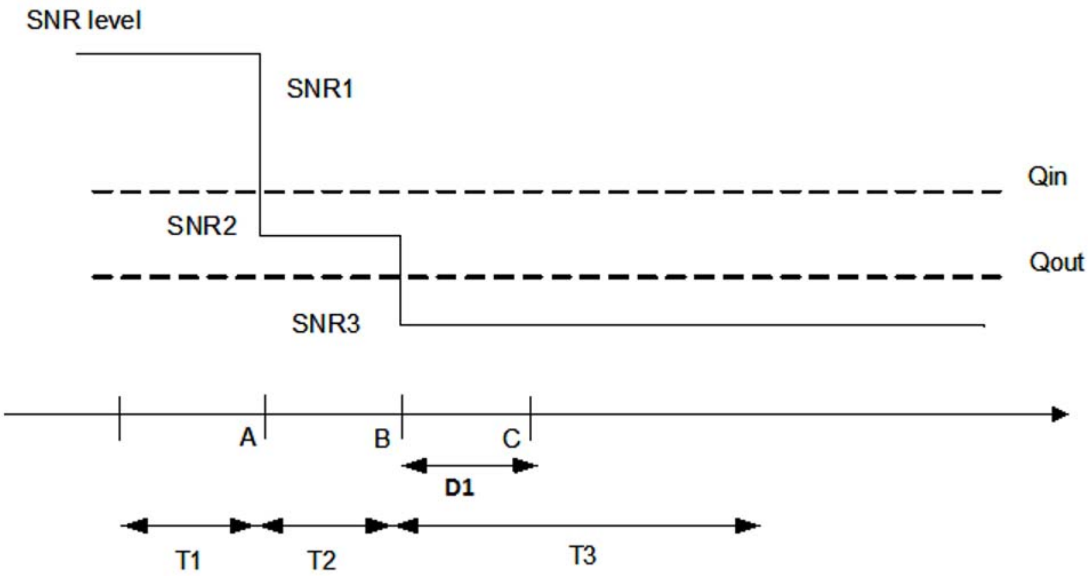


Figure A.6.5.1.3.1-1: SNR variation for out-of-sync testing

A.6.5.1.3.2 Test Requirements

The UE behaviour in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.1.4 Radio Link Monitoring In-sync Test for FR1 PCell configured with SSB-based RLM RS in DRX mode

A.6.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR1 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.6.5.1.4.1-1. The test parameters are given in Tables A.6.5.1.4.1-2, and A.6.5.1.4.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.6.5.1.4.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
2	TDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz
3	TDD, SSB SCS 30 kHz, data SCS 30 kHz, BW 40 MHz
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.4.1-2: General test parameters for FR1 in-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52
	Config 2		10: $N_{RB,c}$ = 52
	Config 3		40: $N_{RB,c}$ = 106
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
PRACH Configuration	Config 1, 2		Table A.3.8.2.1-1
	Config 3		Table A.3.8.2.1-1
SSB index assigned as RLM RS			0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4

	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
CSI-RS for tracking	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.64
T4		s	0.2
T5		s	0.88
D1		s	0.84
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.4.1-3: Cell specific test parameters for FR1 (Cell 1) for in-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	4				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
SNR on other channels and signals	Config 1, 2, 3	dB	1				
N_{oc}	Config 1	dBm/15 kHz	-98				
	Config 2		-98				
	Config 3		-98				
N_{oc}	Config 1	dBm/SCS	-98				
	Config 2		-98				
	Config 3		-95				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in Figure A.6.5.1.4.1-1.
Note 5: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 and T4 is modified as specified in clause A.3.6.

Table A.6.5.1.4.1-4: Void

Table A.6.5.1.4.1-5: Void

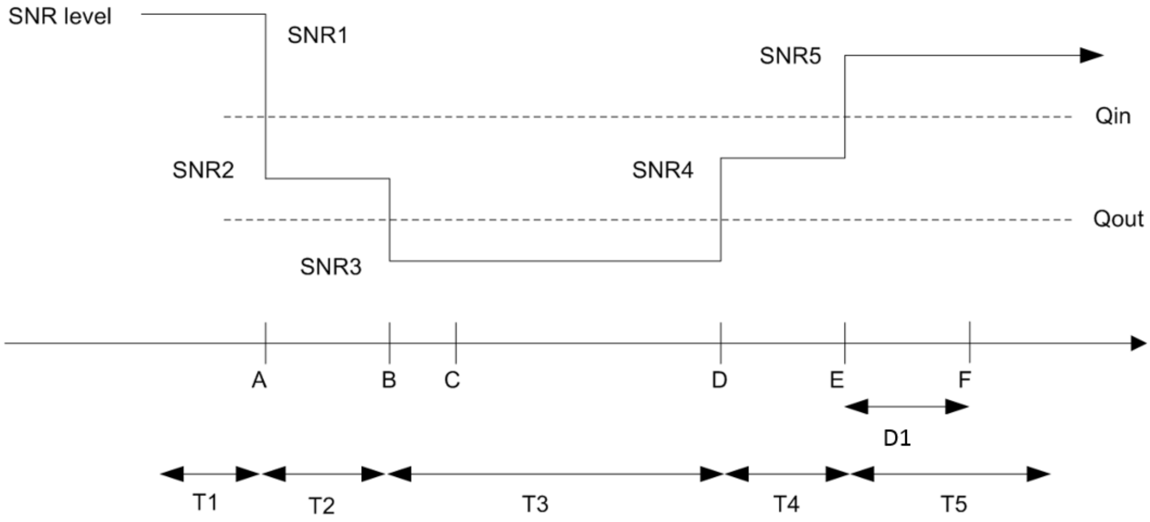


Figure A.6.5.1.4.1-1: SNR variation for in-sync testing.

A.6.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.1.5 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode

A.6.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.6.5.1.5.1-1, A.6.5.1.5.1-2, A.6.5.1.5.1-3, and A.6.5.1.5.1-3A below. There is one cell, cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.5.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test. In the test, SSB0 is configured as the BFD-RS.

Table A.6.5.1.5.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.5.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State.0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*

T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.48
T3		s	0.48
D1		s	0.44
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.5.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
PDCCH_beta		dB	4		
PDCCH_DMRS_beta		dB	4		
PBCH_beta		dB	0		
PSS_beta		dB			
SSS_beta		dB			
PDSCH_beta		dB			
OCNG_beta		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
SNR on other channels and signals	Config 1	dB	1		
	Config 2		1		
	Config 3		1		
N_{oc}	Config 1	dBm/15kHz	-98		
	Config 2		-98		
	Config 3		-98		
Propagation condition			TDL-C 300ns 100Hz		

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.5.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is [A.3.6].

Table A.6.5.1.5.1-3A: Measurement gap configuration for FR1 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
Note 1: Void	

Table A.6.5.1.5.1-4: Void

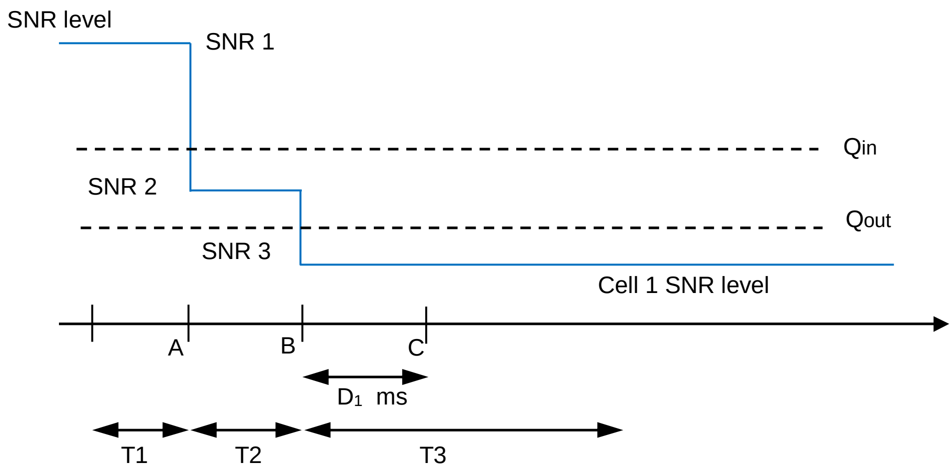


Figure A.6.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.6.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.1.6 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in non-DRX mode

A.6.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.6.5.1.6.1-1, A.6.5.1.6.1-2, and A.6.5.1.6.1-3 below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.6.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is not enabled. In the test, SSB0 is configured as the BFD-RS.

Table A.6.5.1.6.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30kHz SSB SCS, 40 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.6.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State.0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2

	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.44
T4		s	0.2
T5		s	0.88
T6		S	0.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.6.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

<table>
<tr><th colspan="2" rowspan="2">Parameter</th><th rowspan="2">Unit</th><th colspan="5">Test 1</th></tr>
<tr><th>T1</th><th>T2</th><th>T3</th><th>T4</th><th>T5</th></tr>
<tr><td colspan="2">PDCCH_beta</td><td>dB</td><td colspan="5">4</td></tr>
<tr><td colspan="2">PDCCH_DMRS_beta</td><td>dB</td><td colspan="5">4</td></tr>
<tr><td colspan="2">PBCH_beta</td><td>dB</td><td colspan="5" rowspan="5">0</td></tr>
<tr><td colspan="2">PSS_beta</td><td>dB</td></tr>
<tr><td colspan="2">SSS_beta</td><td>dB</td></tr>
<tr><td colspan="2">PDSCH_beta</td><td>dB</td></tr>
<tr><td colspan="2">OCNG_beta</td><td>dB</td></tr>
<tr><td rowspan="3">SNR on RLM-RS</td><td>Config 1</td><td rowspan="3">dB</td><td>1</td><td>-7</td><td>-15</td><td>-4.5</td><td>1</td></tr>
<tr><td>Config 2</td><td>1</td><td>-7</td><td>-15</td><td>-4.5</td><td>1</td></tr>
<tr><td>Config 3</td><td>1</td><td>-7</td><td>-15</td><td>-4.5</td><td>1</td></tr>
<tr><td rowspan="3">SNR on other channels and signals</td><td>Config 1</td><td rowspan="3">dB</td><td colspan="5">1</td></tr>
<tr><td>Config 2</td><td colspan="5">1</td></tr>
<tr><td>Config 3</td><td colspan="5">1</td></tr>
<tr><td rowspan="3">N_{oc}</td><td>Config 1</td><td rowspan="3">dBm/15kHz</td><td colspan="5">-98</td></tr>
<tr><td>Config 2</td><td colspan="5">-98</td></tr>
<tr><td>Config 3</td><td colspan="5">-98</td></tr>
<tr><td colspan="2">Propagation condition</td><td></td><td colspan="5">TDL-C 300ns 100Hz</td></tr>
<tr><td colspan="8">Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.6.5.1.6.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.</td></tr>
</table>

Table A.6.5.1.6.1-4: Void

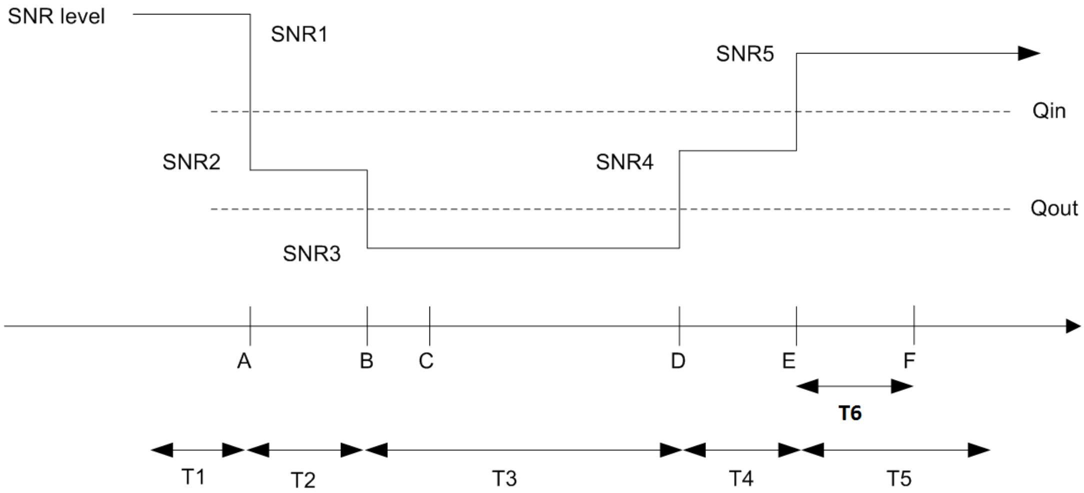


Figure A.6.5.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.6.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.1.7 Radio Link Monitoring Out-of-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode

A.6.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.6.5.1.7.1-1, A.6.5.1.7.1-2, and A.6.5.1.7.1-3 below. There is one cell, cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.6.5.1.7.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test. In the test, SSB0 is configured as the BFD-RS.

Table A.6.5.1.7.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.7.1-2: General test parameters for FR1 PCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State.0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			Enabled
T310 timer		ms	0
T311 timer		ms	1000
N310			1
N311			1

CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.7.1-3: Cell specific test parameters for FR1 for CSI-RS out-of-sync radio link monitoring in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
PDCCH_beta		dB	4		
PDCCH_DMRS_beta		dB	4		
PBCH_beta		dB	0		
PSS_beta		dB			
SSS_beta		dB			
PDSCH_beta		dB			
OCNG_beta		dB			
SNR on RLM-RS	Config 1	dB	1	-7	-15
	Config 2		1	-7	-15
	Config 3		1	-7	-15
SNR on other channels and signals	Config 1	dB	1		
	Config 2		1		
	Config 3		1		
N_{oc}	Config 1	dBm/15kHz	-98		
	Config 2		-98		
	Config 3		-98		
Propagation condition			TDL-C 300ns 100Hz		

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.6.5.1.7.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

Table A.6.5.1.7.1-4: Void

Table A.6.5.1.7.1-5: Void

Table A.6.5.1.7.1-6: Void

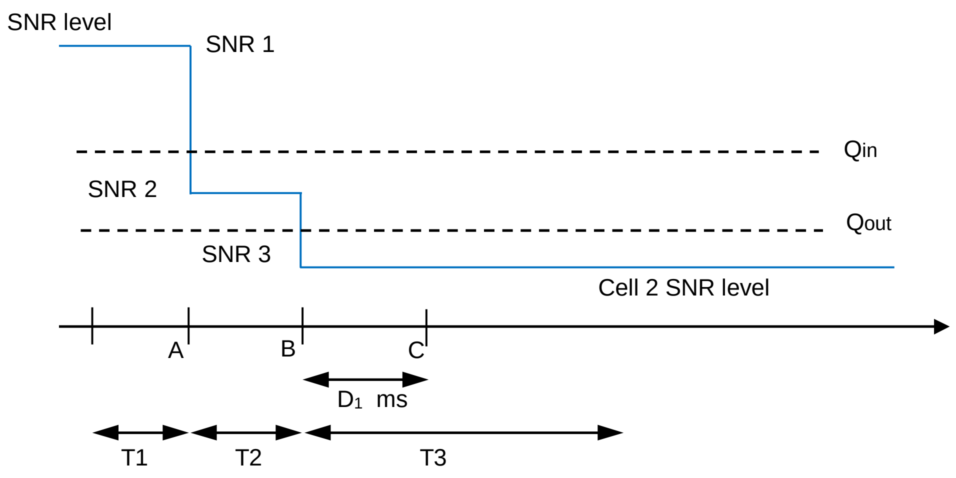


Figure A.6.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.6.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on PCell.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D_1 ms after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.1.8 Radio Link Monitoring In-sync Test for FR1 PCell configured with CSI-RS-based RLM in DRX mode

A.6.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR1 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.6.5.1.8.1-1, A.6.5.1.81-2, A.6.5.1.8.1-3 and A.6.5.1.8.1-3A below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.1.8.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test. In the test, SSB0 is configured as the BFD-RS.

Table A.6.5.1.8.1-1: Supported test configurations for FR1 PSCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30kHz SSB SCS, 40 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.1.8.1-2: General test parameters for FR1 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		FDD
	Config 2, 3		TDD
TDD Configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1
CORESET Reference Channel	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
SSB Configuration	Config 1		SSB.1 FR1
	Config 2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration	Config 1, 2		SMTC.1
	Config 3		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 kHz
	Config 3		30 kHz
TRS configuration	Config 1		TRS.1.1 FDD
	Config 2		TRS.1.1 TDD
	Config 3		TRS.1.2 TDD
CSI-RS for RLM	Config 1		Resource #4 in TRS.1.1 FDD
	Config 2		Resource #4 in TRS.1.1 TDD
	Config 3		Resource #4 in TRS.1.2 TDD
TCI configuration for PDCCH/PDSCH			TCI.State.0
OCNG parameters			OP.1
CP length			Normal
Correlation Matrix and Antenna Configuration			2x2 Low
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2

	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			gp0
Layer 3 filtering			Enabled
T310 timer		ms	2000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD
	Config 2		CSI-RS.1.1 TDD
	Config 3		CSI-RS.2.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	1.24
T4		s	0.2
T5		s	1.88
T6		s	1.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.6.5.1.8.1-3: Cell specific test parameters for FR1 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
PDCCH_beta		dB	4				
PDCCH_DMRS_beta		dB	4				
PBCH_beta		dB	0				
PSS_beta		dB					
SSS_beta		dB					
PDSCH_beta		dB					
OCNG_beta		dB					
SNR on RLM-RS	Config 1	dB	1	-7	-15	-4.5	1
	Config 2		1	-7	-15	-4.5	1
	Config 3		1	-7	-15	-4.5	1
SNR on other channels and signals	Config 1	dB	1				
	Config 2		1				
	Config 3		1				
N_{oc}	Config 1	dBm/15kHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.6.5.1.8.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.1.1.

Table A.6.5.1.8.1-3A: Measurement gap configuration for FR1 CSI-RS in-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
Note 1: Void	

Table A.6.5.1.8.1-4: Void

Table A.6.5.1.8.1-5: Void

Table A.6.5.1.8.1-6: Void

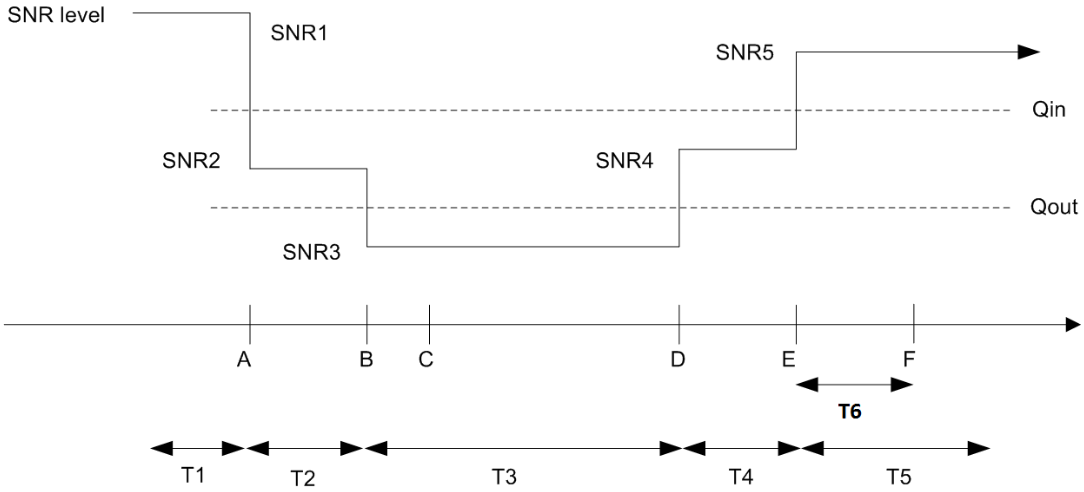


Figure A.6.5.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.6.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (T6 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.2 Interruption

A.6.5.2.1 Interruptions during measurements on deactivated NR SCC in FR1

A.6.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE missed ACK/NACK rate does not exceed the limits at NR PSCell interruptions during the measurement on the deactivated NR SCC. This test will verify the missed ACK/NACK rate for PCell in standalone NR specified in clause 8.2.2.2. Supported test configurations are shown in table A.6.5.2.1.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.6.5.2.1.1-2 and A 6.5.2.1.1-3 below. In the test there are two cells: Cell1 and Cell2. Cell1 is PCell, Cell2 is an NR deactivated SCell. Cell1 shall be configured as PCell and Cell2 shall be configured as SCell.

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector defines the start of time period T1. During T1, PCell is continuously scheduled in DL.

Table A.6.5.2.1.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD – FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD – TDD duplex mode
3	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD – FDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD – TDD duplex mode
5	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD – TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.5.2.1.1-2: General test parameters for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two NR RF channels
Active PCell		Cell1	PCell on NR RF channel number 1.
Configured deactivated SCell		Cell2	Deactivated SCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell1 and Cell2
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.6.5.2.1.1-3: NR cell specific test parameters for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter		Unit	Cell1	Cell2
Frequency Range			FR1	FR1
Duplex mode	Config 1		FDD	FDD
	Config 2,5		TDD	TDD
	Config 3		TDD	FDD
	Config 4		FDD	TDD
TDD configuration	Config 1		Not Applicable	Not Applicable
	Config 2		TDDConf.1.1	TDDConf.1.1
	Config 3		TDDConf.1.1	Not Applicable
	Config 4		Not Applicable	TDDConf.1.1
	Config 5		TDDConf.1.2	TDDConf.1.2
$BW_{channel}$	Config 1,2,3,4		10 MHz: $N_{RB,c}$ = 52	10 MHz: $N_{RB,c}$ = 52
	Config 5		40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration			DLBWP.0.2^{Note6}	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.1.1 FDD
	Config 2		SR.1.1 TDD	SR.1.1 TDD
	Config 3		SR.1.1 TDD	SR.1.1 FDD
	Config 4		SR.1.1 FDD	SR.1.1 TDD
	Config 5		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.1.1 FDD
	Config 2		CR.1.1 TDD	CR.1.1 TDD
	Config 3		CR.1.1 TDD	CR.1.1 FDD
	Config 4		CR.1.1 FDD	CR.1.1 TDD
	Config 5		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.1.1 FDD
	Config 2		CCR.1.1 TDD	CCR.1.1 TDD
	Config 3		CCR.1.1 TDD	CCR.1.1 FDD
	Config 4		CCR.1.1 FDD	CCR.1.1 TDD
	Config 5		CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1
SSB Configuration	Config 1,2,3,4		SSB.1 FR1	SSB.1 FR1
	Config 5		SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	1x2 Low
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
$N_{oc}$$^{Note 2}$		dBm/15 kHz	-104	-104
SS-RSRP $^{Note 3}$		dBm/15 kHz	-87	-87
$\hat{E}_s/I_{ot}$		dB	17	17
$\hat{E}_s/N_{oc}$		dB	17	17
$N_{oc}$$^{Note 2}$	Config 1,2,3,4	dBm/SCS	-104	-104
	Config 5		-101	-101
Io^{Note3}	Config 1,2,3,4	dBm/ 9.36MHz	-58.96	-58.96

	Config 5	dBm/ 38.16MHz	-52.86	-52.86
Time offset to Cell1 Note 5		µs	-	3
Propagation Condition			AWGN	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modeled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselvess.
Note 4: Void
Note 5: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
Note 6: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in clause 12 of TS 38.213 [3].

A.6.5.2.1.2 Test Requirements

The UE shall be continuously scheduled on PCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on PCell.

The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on PCell shall not exceed the value defined in Table A.6.5.2.1.2-1 if the PCell is not in the same band as the deactivated SCell or Table A.6.5.2.1.2-2 if the PCell is in the same band as the deactivated SCell.

Table A.6.5.2.1.2-1: Interruption duration if the PCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	1
1	0.5	1

Table A.6.5.2.1.2-2: Interruption duration if the PCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length
0	1	1 + SMTC duration
1	0.5	1 + SMTC duration

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.3 SCell Activation and Deactivation Delay

A.6.5.3.1 SCell Activation and deactivation of known SCell in FR1 in non-DRX for 160ms SCell measurement cycle

A.6.5.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations are shown in table A.6.5.3.1.1-1 below. The test parameters are given in Tables A.6.5.3.1.1-2 and cell-specific parameters in A.6.5.3.1.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1, but is not aware of Cell2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot $\mathrm{n}+\frac{T_{\mathrm{HARQ}}+T_{\mathrm{activation\_time}}+T_{\mathrm{CSI\_Reporting}}}{\mathrm{NR\ slot\ length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PCell in slot $n+\frac{T_{\mathrm{HARQ}}+3\mathrm{ms}}{\mathrm{NR\ slot\ length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n+1+\frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n+1+\frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}}+N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot $\mathrm{m}+\frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3, and The starting point of any PCell interruption due to the deactivation shall occur in the slot $\mathrm{m}+1+\frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to $\mathrm{m}+1+\frac{\mathrm{T_{HARQ}+3ms}}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.6.5.3.1.1-1: known FR1 SCell activation in non-DRX for 160ms SCell measurement cycle supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.5.3.1.1-2: General test parameters for known FR1 SCell activation case, 160ms SCell measurement cycle

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channel (1, 2) are used for this test
Active PCell		Cell 1	Primary cell on NR RF channel number 1.
Configured deactivated SCell		Cell 2	Configured deactivated secondary cell on NR RF channel number 2
CP length		Normal	
DRX		OFF	Continuous monitoring of primary cell
CQI/PMI periodicity and offset configuration index		0	CQI reporting for SCell every four slot
Cell-individual offset for cells on NR channel number	dB	0	Individual offset for cells on primary component carrier.
SCell measurement cycle (measCycleSCell)	ms	160	
Cell2 timing offset to cell1	µs	0	
Time alignment error between cell2 and cell1	µs	≤ Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.	The value of time alignment error depends upon the type of carrier aggregation.
T1	s	7	During this time the PSCell shall be known and the SCell configured and detected.
T2	s	1	During this time the UE shall activate the SCell.
T3	s	1	During this time the UE shall deactivate the SCell.
T_{HARQ}	ms	k_1×NR slot length	k_1 is a number of slots and is indicated by the PDSCH-to-HARQ-timing-indicator field in the DCI format, if present, or provided by *dl-DataToUL-ACK*, the value of k should be the minimum value defined in TS 38.213 [3] depends on UE's capability
$T_{CSI\_Reporting}$	ms	2	the delay uncertainty in acquiring the first available CSI reporting resources as specified in TS 38.331 [2]

Table A.6.5.3.1.1-3: Cell specific test parameters for known FR1 SCell activation case, 160ms SCell measurement cycle

Parameter		Unit	T1		T2		T3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.1.2					
$BW_{channel}$	Config 1,2	MHz	10: $N_{RB,c}$ = 52					
	Config 3		40: $N_{RB,c}$ = 106					
Initial BWP configuration			DLBWP.0.2					
TCI state			TCI.State.0					
TRS Configuration			TRS.1.1 TDD					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
RMSI CORESET parameters	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
OCNG Patterns			OP.1					
SSB Configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
SMTC configuration			SMTC.1					
EPRE ratio of PSS to SSS		dB	0					
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								
N_{oc} Note2	Config 1,2,4,5	dBm/15kHz	-104					
	Config 3,6		-101					
$\hat{E}_s/I_{ot}$		dB	17					
$\hat{E}_s/N_{oc}$		dB	17					
SS-RSRP Note3	Config 1,2,4,5	dBm/SCS	-87					
	Config 3,6		-84					
SCH_RP Note 3		dBm/15 kHz	-87					
Propagation condition		-	AWGN					

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T2.

A.6.5.3.1.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot ($\mathrm{n} + 1 + \frac{\mathrm{T_{HARQ}+3ms}}{NR\ slot\ length}$). UE is allowed to postpone CSI report to next available uplink resource if an available uplink resource is subject to interruption.

During T2 the UE shall start sending CSI reports for SCell with non-zero CQI index at latest in a slot $\mathrm{n} + \frac{\mathrm{T_{HARQ}}+T_{\mathrm{activtion\_time}}+T_{\mathrm{CSI\_Reporting}}}{NR\ slot\ length}$, $\mathrm{T_{activation\_time}} = \mathrm{T_{FirstSSB}}$+ 5ms, as defined in clause 8.3.

During T3 the UE shall stop sending CSI reports for SCell at latest in a slot $\mathrm{m} + \frac{\mathrm{T_{HARQ}+3ms}}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell / PSCell during SCell activation shall not happen outside the slot $n + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n + 1 + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot $\mathrm{m} + 1 + \frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to $\mathrm{m} + 1 + \frac{\mathrm{T_{HARQ}+3ms}}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption on any activated serving cell shall not be more than the values specified for SA in clause 8.2.2.2.2.

All of the above test requirements shall be fulfilled in order for the observed SCell activation delay and SCell deactivation delay to be counted as correct. The rate of correct observed SCell activation delay and SCell deactivation delay during repeated tests shall be at least 90%.

NOTE: During T2 if there are no uplink resources for reporting the valid CSI in a slot $\frac{\mathrm{T_{HARQ}}+T_{\mathrm{activtion\_time}}+T_{\mathrm{CSI\_Reporting}}}{NR\ slot\ length}$ as defined in clause 8.3 then the UE shall use the next available uplink resource for reporting the corresponding valid CSI.

A.6.5.3.2 SCell Activation and deactivation of known SCell in FR1 in non-DRX for 320ms SCell measurement cycle

A.6.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.6.5.3.1.1. The supported test configurations are the same as defined in clause A.6.5.3.1.1. The test parameters are the same except those described in the following clause. The listed parameter values in Tables A.6.5.3.2.1-1 will replace the values of corresponding parameters in Tables A.4.5.3.1.1-1.

Table A.6.5.3.2.1-1: General test parameters for known FR1 SCell activation case, 320ms SCell measurement cycle

Parameter	Unit	Value	Comment
SCell measurement cycle (measCycleSCell)	ms	320	

A.6.5.3.2.2 Test Requirements

The test requirements defined in clause A.6.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value $T_{FirstSSB\_MAX} + T_{rs} + 5ms$.

A.6.5.3.3 SCell Activation and deactivation of unknown SCell in FR1 in non-DRX

A.6.5.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SCell activation and deactivation times are within the requirements stated in clause 8.3, when the SCell in FR1 is known by the UE at the time of activation.

The supported test configurations are shown in table A.6.5.3.1.1-1 below. The test parameters are given in Tables A.6.5.3.1.1-2 and cell-specific parameters in A.6.5.3.1.1-3 below. The test consists of three successive time periods, with duration of T1, T2 and T3, respectively. There are two NR carriers, each with one cell. Both cells have constant signal levels throughout the test. Before the test starts the UE is connected to Cell 1, but is not aware of Cell2. The UE is only monitoring the PCC. The UE shall be continuously scheduled in the PCell throughout the whole test.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on radio channel 2. The UE now starts monitoring the SCC. The test equipment sends a MAC message for activation of the SCell.

The point in time at which the MAC message is received at the UE antenna connector, in slot # denoted n, defines the start of time period T2. The UE shall be able to report valid CSI in PCell for the activated SCell at latest in slot $\mathrm{n} + \frac{T_{\mathrm{HARQ}}+T_{\mathrm{activation\_time}}+T_{\mathrm{CSI\_Reporting}}}{\mathrm{NR\ slot\ length}}$, as defined in clause 8.3. The UE shall start reporting CSI in PCell in slot $n + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}}{\mathrm{NR\ slot\ length}}$ and shall report CQI index 0 (out-of-range) until the SCell activation has been completed. Any PCell interruption due to activation of SCell shall occur in the slot $n + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $n + 1 + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}} + N_{\mathrm{interruption}}$, as defined in clause 8.3, where $N_{\mathrm{interruption}}$ is the interruption length given in clause 8.2.

Time period T3 starts when a MAC message for deactivation of SCell, sent from the test equipment to the UE in a slot # denoted m, is received at the UE antenna connector. The UE shall carry out deactivation of the SCell in a slot $\mathrm{m} + \frac{\mathrm{T_{HARQ}}+3ms}{NR\ slot\ length}$, as defined in clause 8.3, and The starting point of any PCell interruption due to the deactivation shall occur in the slot $\mathrm{m} + 1 + \frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to $\mathrm{m} + 1 + \frac{\mathrm{T_{HARQ}+3ms}}{NR\ slot\ length}$, as defined in clause 8.3.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell during activation and deactivation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell deactivation command is sent until CQI reporting for SCell is discontinued.

Table A.6.5.3.3.1-1: General test parameters for unknown FR1 SCell activation case, 160ms SCell measurement cycle

Parameter	Unit	Value	Comment
T1	ms	100	During this time the PSCell shall be known and the SCell configured, but not detected.

A.6.5.3.3.2 Test Requirements

The test requirements defined in clause A.6.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value $T_{FirstSSB\_MAX} + T_{SMTC\_MAX} + 2*T_{rs} + 5ms$ as defined in clause 8.3.

A.6.5.4 UE UL carrier RRC reconfiguration Delay

A.6.5.4.1 UE UL carrier RRC reconfiguration Delay

Table A.6.5.4.1-1 - Table A.6.5.4.1-4 : Void

A.6.5.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that when the UE receives a RRC message implying NR UL or Supplementary UL carrier configuration, the UE shall be ready to start transmission on the newly configured carrier within the time limits specified in clause 8.4.2 and 8.4.3 for configuring and deconfiguring, respectively.

There are two cells: FR1 PCell (cell 1) and FR1 SCell (cell 2). Both NR uplink and supplementary uplink are broadcast by *ServingCellConfigCommonSIB.* The test parameters for PCell and SCell are given in Table A. 6.5.4.1.1-1, Table A.6.5.4.1.1-2, Table A.6.5.4.1.1-3 and Table A.6.5.4.1.1-4 below. In test 1, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, NR uplink of cell 2 is configured to UE. At the start of T2, a supplementary uplink of cell 2 is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the supplementary uplink is released through *RRCReconfiguration*.

In test 2, the test consists of three time periods, with duration of T1, T2 and T3 respectively. During time duration T1, supplementray uplink on cell 2 is configured to UE. At the start of T2, a NR uplink is configured to UE through *RRCReconfiguration*, then UE shall start transmission both on the NR uplink and supplementary uplink. At the start of T3, the NR uplink is released through *RRCReconfiguration*.

Table A.6.5.4.1.1-1: Supported test configurations

Configuration	PCell (Cell 1)	SCell (Cell 2)
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	DL and UL: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; SUL: 15 kHz SCS, 10 MHz bandwidth, SUL duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	DL and UL: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode; SUL: 15 kHz SCS, 10 MHz bandwidth, SUL duplex mode
3	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	DL and UL: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; SUL: 30kHz SCS, 40 MHz bandwidth, SUL duplex mode
4	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	DL and UL: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; SUL: 15 kHz SCS, 10 MHz bandwidth, SUL duplex mode
5	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	DL and UL: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode; SUL: 15 kHz SCS, 10 MHz bandwidth, SUL duplex mode
6	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	DL and UL: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; SUL: 30kHz SCS, 40 MHz bandwidth, SUL duplex mode
7	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	DL and UL: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode; SUL: 15 kHz SCS, 10 MHz bandwidth, SUL duplex mode
8	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	DL and UL: 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode; SUL: 15 kHz SCS, 10 MHz bandwidth, SUL duplex mode
9	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	DL and UL: 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode; SUL: 30kHz SCS, 40 MHz bandwidth, SUL duplex mode
Note: The UE is only required to be tested in one of the supported test configurations		

Table A.6.5.4.1.1-2: General test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on Pcell

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1,2,3, 4, 5, 6, 7, 8, 9	1, 2	Two radio channels are used for these two tests.
Active cell		Config 1,2,3, 4, 5, 6, 7, 8, 9	Cell 1: FR1 PCell Cell 2: FR1 SCell	PCell on RF channel number 1 FR1 SCell on RF channel number 2
CP length		Config 1,2,3, 4, 5, 6, 7, 8, 9	Normal	
DRX		Config 1,2,3, 4, 5, 6, 7, 8, 9	OFF	
Measurement gap pattern Id		Config 1,2,3, 4, 5, 6, 7, 8, 9	OFF	
Filter coefficient		Config 1,2,3, 4, 5, 6, 7, 8, 9	0	L3 filtering is not used
T1	s	Config 1,2,3, 4, 5, 6, 7, 8, 9	5	
T2	s	Config 1,2,3, 4, 5, 6, 7, 8, 9	5	
T3	s	Config 1,2,3, 4, 5, 6, 7, 8, 9	5	

Table A.6.5.4.1.1-3: NR Cell specific test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on PCell (Cell 1)

Parameter	Unit	Test Configuration	Test 1			Test 2		
			T1	T2	T3	T1	T2	T3
Channel number		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	1			1		
TDD configuration		Conf 1, 2, 3	N/A			N/A		
		Conf 4, 5, 6	TDD Conf.1.1			TDD Conf.1.1		
		Conf 7, 8, 9	TDD Conf.2.1			TDD Conf.2.1		
$BW_{channel}$	MHz	Conf 1, 2, 3	10: $N_{RB,c}$ = 52			10: $N_{RB,c}$ = 52		
		Conf 4, 5, 6	10: $N_{RB,c}$ = 52			10: $N_{RB,c}$ = 52		
		Conf 7, 8, 9	40: $N_{RB,c}$ = 106			40: $N_{RB,c}$ = 106		
PDSCH reference measurement channel as defined in A.3.1.1		Conf 1, 2, 3	SR.1.1 FDD			SR.1.1 FDD		
		Conf 4, 5, 6	SR.1.1 TDD			SR.1.1 TDD		
		Conf 7, 8, 9	SR 2.1 TDD			SR 2.1 TDD		
RMSI CORESET reference measurement channel as defined in A.3.1.2		Conf 1, 2, 3	CR.1.1 FDD			CR.1.1 FDD		
		Conf 4, 5, 6	CR.1.1 TDD			CR.1.1 TDD		
		Conf 7, 8, 9	CR.2.1 TDD			CR.2.1 TDD		
RMC CORESET reference measurement channel as defined in A.3.1.3		Conf 1, 2, 3	CCR.1.1 FDD			CCR.1.1 FDD		
		Conf 4, 5, 6	CCR.1.1 TDD			CCR.1.1 TDD		
		Conf 7, 8, 9	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern Note 1		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	OP.1			OP.1		
SSB configuration		Conf 1, 2, 3, 4, 5, 6	SSB.1 FR1			SSB.1 FR1		
		Conf 7, 8, 9	SSB.2 FR1			SSB.2 FR1		
SMTC configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	SMTC.1			SMTC.1		
DL initial BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.0.1			DLBWP.0.1		
DL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.1.1			DLBWP.1.1		
UL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	ULBWP.1.1			ULBWP.1.1		
EPRE ratio of PSS to SSS	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	0			0		
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								

EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS								
EPRE ratio of OCNG to OCNG DMRS								
N_{oc} Note 2	dBm / 15kHz	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	-102			-102		
	dBm/ SCS	Conf 1,2,3,4,5,6	-102			-102		
		Conf 7,8,9	-99			-99		
$\hat{E}_s/N_{oc}$	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16
$\hat{E}_s/I_{ot}$ Note 3	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16
SS-RSRP Note 3	dBm/ SCS	Conf 1,2,3,4,5,6	-86	-86	-86	-86	-86	-86
		Conf 7,8,9	-83	-83	-83	-83	-83	-83
Io Note 3	dBm/ 9.36 MHz	Conf 1,2,3,4,5,6	-57.9	-57.9	-57.9	-57.9	-57.9	-57.9
	dBm/ 38.16 MHz	Conf 7,8,9	-51.8	-51.8	-51.8	-51.8	-51.8	-51.8
Propagation Condition		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	AWGN			AWGN		
Antenna configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	1 x 2			1 x 2		

NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols.

NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

NOTE 3: $\hat{E}_s/I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.5.4.1.1-4: NR Cell specific test parameters for NR standalone UE UL carrier RRC reconfiguration Delay on SCell (Cell 2)

Parameter	Unit	Test Configuration	Test 1			Test 2		
			T1	T2	T3	T1	T2	T3
Channel number		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	2			2		
TDD configuration		Conf 1, 4, 7	N/A			N/A		
		Conf 2, 5, 8	TDDConf.1.1			TDDConf.1.1		
		Conf 3, 6, 9	TDDConf.2.1			TDDConf.2.1		
$BW_{channel}$	MHz	Conf 1, 4, 7	10: $N_{RB,c}$ = 52			10: $N_{RB,c}$ = 52		
		Conf 2, 5, 8	10: $N_{RB,c}$ = 52			10: $N_{RB,c}$ = 52		
		Conf 3, 6, 9	40: $N_{RB,c}$ = 106			40: $N_{RB,c}$ = 106		
PUSCH parameters for NR UL carrier		Conf 1, 4, 7	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	N/A	G-FR1-A3-10 in [13]	N/A
		Conf 2, 5, 8	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	N/A	G-FR1-A3-10 in [13]	N/A
		Conf 3, 6, 9	G-FR1-A3-14 in [13]	G-FR1-A3-14 in [13]	G-FR1-A3-14 in [13]	N/A	G-FR1-A3-14 in [13]	N/A
PUCCH parameters For NR UL carrier		Conf 1, 4, 7	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	N/A	N/A	N/A
		Conf 2, 5, 8	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	N/A	N/A	N/A
		Conf 3, 6, 9	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]	N/A	N/A	N/A
PUSCH parameters for supplementary UL		Conf 1, 4, 7	N/A	G-FR1-A3-10 in [13]	N/A	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]
		Conf 2, 5, 8	N/A	G-FR1-A3-10 in [13]	N/A	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]	G-FR1-A3-10 in [13]
		Conf 3, 6, 9	N/A	G-FR1-A3-14 in [13]	N/A	G-FR1-A3-14 in [13]	G-FR1-A3-14 in [13]	G-FR1-A3-14 in [13]
PUCCH parameters for supplementary UL		Conf 1, 4, 7	N/A	N/A	N/A	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]
		Conf 2, 5, 8	N/A	N/A	N/A	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]	Table 8.3.3.1.2-1 in [13]
		Conf 3, 6, 9	N/A	N/A	N/A	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]	Table 8.3.3.1.2-2 in [13]
PDSCH reference measurement channel as defined in A.3.1.1		Conf 1, 4, 7	SR.1.1 FDD			SR.1.1 FDD		
		Conf 2, 5, 8	SR.1.1 TDD			SR.1.1 TDD		
		Conf 3, 6, 9	SR 2.1 TDD			SR 2.1 TDD		

RMSI CORESET reference measurement channel as defined in A.3.1.2		Conf 1, 4, 7	CR.1.1 FDD			CR.1.1 FDD		
		Conf 2, 5, 8	CR.1.1 TDD			CR.1.1 TDD		
		Conf 3, 6, 9	CR.2.1 TDD			CR.2.1 TDD		
RMC CORESET reference measurement channel as defined in A.3.1.3		Conf 1, 4, 7	CCR.1.1 FDD			CCR.1.1 FDD		
		Conf 2, 5, 8	CCR.1.1 TDD			CCR.1.1 TDD		
		Conf 3, 6, 9	CCR.2.1 TDD			CCR.2.1 TDD		
OCNG Pattern Note 1		Conf 1, 2, 3	OP.1			OP.1		
SSB configuration		Conf 1, 2, 4, 5, 7,8	SSB.1 FR1			SSB.1 FR1		
		Conf 3, 6, 9	SSB.2 FR1			SSB.2 FR1		
SMTC configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	SMTC.1			SMTC.1		
DL initial BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.0.1			DLBWP.0.1		
DL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	DLBWP.1.1			DLBWP.1.1		
UL dedicated BWP configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	ULBWP.1.1			ULBWP.1.1		
EPRE ratio of PSS to SSS	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	0			0		
EPRE ratio of PBCH_DMRS to SSS								
EPRE ratio of PBCH to PBCH_DMRS								
EPRE ratio of PDCCH_DMRS to SSS								
EPRE ratio of PDCCH to PDCCH_DMRS								
EPRE ratio of PDSCH_DMRS to SSS								
EPRE ratio of PDSCH to PDSCH_DMRS								
EPRE ratio of OCNG DMRS to SSS								
EPRE ratio of OCNG to OCNG DMRS								
N_{oc} Note 2	dBm / 15kHz	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	-102			-102		
	dBm/ SCS	Conf 1, 2, 4, 5, 7,8	-102			-102		
		Conf 3, 6, 9	-99			-99		
$\hat{E}_s/N_{oc}$	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16
$\hat{E}_s/I_{ot}$ Note 3	dB	Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	16	16	16	16	16	16

SS-RSRP Note 3	dBm/ SCS	Conf 1, 2, 4, 5, 7,8	-86	-86	-86	-86	-86	-86
		Conf 3, 6, 9	-83	-83	-83	-83	-83	-83
Io Note 3	dBm/ 9.36 MHz	Conf 1, 2, 4, 5, 7,8	-57.9	-57.9	-57.9	-57.9	-57.9	-57.9
	dBm/ 38.16 MHz	Conf 3, 6, 9	-51.8	-51.8	-51.8	-51.8	-51.8	-51.8
Propagation Condition		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	AWGN			AWGN		
Antenna configuration		Conf 1, 2, 3, 4, 5, 6, 7, 8, 9	1 x 2			1 x 2		
NOTE 1: OCNG shall be used such that both cells are fully allocated, and a constant total transmitted power spectral density is achieved for all OFDM symbols. NOTE 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. NOTE 3: $\hat{E}_s/I_{ot}$, Io, and SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.								

A.6.5.4.1.2 Test Requirements

In test 1 the UE shall be ready to start transmission on the supplementary uplink carrier on SCell within 20ms from the start of T2.

In test 1 the UE shall stop the transmission on the supplementary uplink carrier on SCell within 20ms from the start of T3.

In test 2 the UE shall be ready to start transmission on the NR uplink carrier on SCell within 20ms from the start of T2.

In test 2 the UE shall stop the transmission on the NR uplink carrier on SCell within 20ms from the start of T3.

All of the above test requirements shall be fulfilled in order for the observed UE UL carrier configuration delay and UE UL carrier release delay to be counted as correct. The rate of correct observed UE UL carrier configuration delay and UE UL carrier release delay during repeated tests shall be at least 90%.

A.6.5.4.2 Void

A.6.5.5 Beam Failure Detection and Link recovery procedures

A.6.5.5.1 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in non-DRX mode

A.6.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.6.5.5.1.1-1, A.6.5.5.1.1-2, A.6.5.5.1.1-3 and A.6.5.5.1.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.1.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.6.5.5.1.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 1.

Table A.6.5.5.1.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.1.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
BWchannel	Config 1	MHz	10: NRB,c = 52	
	Config 2		10: NRB,c = 52	
	Config 3		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
SSB Configuration	Config 1		SSB.3 FR1	
	Config 2		SSB.3 FR1	
	Config 3		SSB.4 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.2.2-1	
	Config 3		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	

	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in\_LR\_SSB}$
	Config 3		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
SSB Index assigned as RLM RS		0, 1		
T310 Timer	ms	1000		
N310		2		
T1		s	0.2	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.37	
T3		s	0.24	
T4		s	0	
T5		s	0.17	
D1		s	0.13	

Note 1:	All configurations are assigned to the UE prior to the start of time period T1.
Note 2:	UE-specific PDCCH is not transmitted after T1 starts.

Table A.6.5.5.1.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	**T2**	**T3**	**T4**	**T5**
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300ns 100Hz				
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1. Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs. Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1. Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.							

Table A.6.5.5.1.1-4: Void

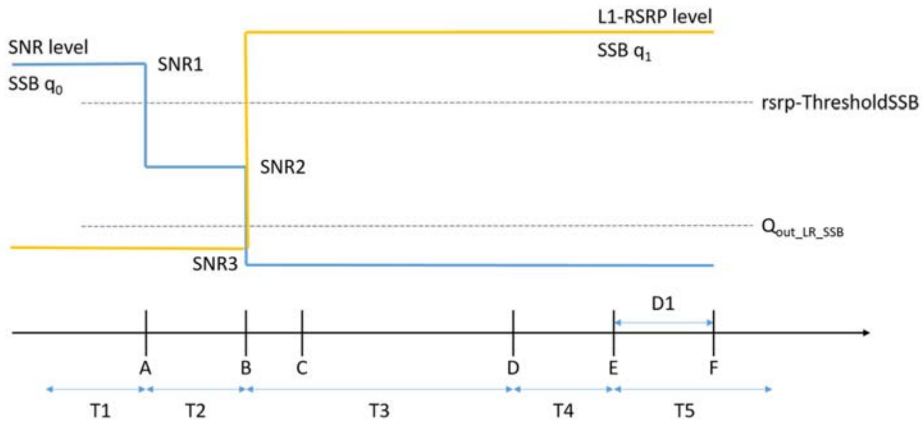


Figure A.6.5.5.1.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.6.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 120+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.5.2 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with SSB-based BFD and LR in DRX mode

A.6.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.6.5.5.2.1-1, A.6.5.5.2.1-2, A.6.5.5.2.1-3, A.6.5.5.2.1-4 and A.6.5.5.2.1-5 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.2.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.6.5.5.2.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.6.5.5.2.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.2.1-2: General test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PSCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
BWchannel	Config 1	MHz	10: NRB,c = 52	
	Config 2		10: NRB,c = 52	
	Config 3		40: NRB,c = 106	
DL initial BWP configuration	Config 1, 2, 3		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2, 3		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2, 3		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2, 3		ULBWP.1.1	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
CORESET Reference Channel	Config 1		CR.1.1 FDD	
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
SSB Configuration	Config 1		SSB.3 FR1	
	Config 2		SSB.3 FR1	
	Config 3		SSB.4 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.2.2-1	
	Config 3		Table A.3.8.2.2-1	
SSB Index assigned as BFD RS (q_0)			0	
SSB Index assigned as CBD RS (q_1)			1	
OCNG parameters			OP.1	
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	

	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
rlmInSyncOutOfSyncThreshold			Absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in\_LR\_SSB}$
	Config 3		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
CSI-RS for tracking	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	

SSB Index assigned as RLM RS		0, 1		
T310 Timer	ms	1000		
N310		2		
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	5.17	
T3		s	3.24	
T4		s	0	
T5		s	1.97	
D1		s	1.93	
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.5.2.1-3: Cell specific test parameters for FR1 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.6.5.5.2.1-4: Void

Table A.6.5.5.2.1-5: Void

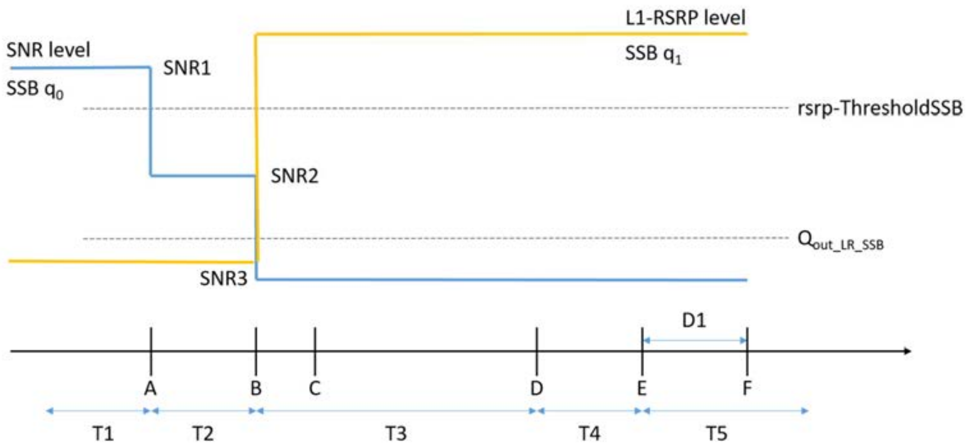


Figure A.6.5.5.2.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.6.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.5.3 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.6.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.6.5.5.3.1-1, A.6.5.5.3.1-2, and below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.3.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.6.5.5.3.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled.

Table A.6.5.5.3.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.3.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
SSB Configuration	Config 1		SSB.1 FR1	A.3.10
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	A.3.11
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	N
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in\_LR\_SSB}$

	Config 3		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1	Config 1		CSI-RS.1.2 FDD	A.3.14
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	A.3.14
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
CSI-RS-Index assigned as RLM RS	Config 1		CSI-RS.1.2 FDD	A.3.14
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	0.2	During this time the the UE shall be fully synchronized to cell 1
T2		s	0.18	
T3		s	0.14	
T4		s	0	
T5		s	0.08	
D1		s	0.04	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.5.3.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-108	-108	-88	-88	-88
	Config 2		-108	-108	-88	-88	-88
	Config 3		-105	-105	-85	-85	-85
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.6.5.5.3.1-4: Void

Table A.6.5.5.3.1-5: Void

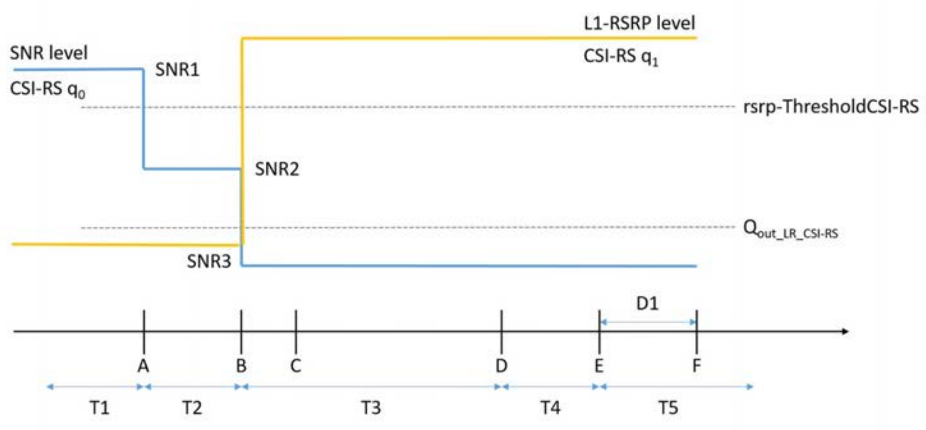


Figure A.6.5.5.3.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

A.6.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 30+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.5.4 Beam Failure Detection and Link Recovery Test for FR1 PCell configured with CSI-RS-based BFD and LR in DRX mode

A.6.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR1 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.6.5.5.4.1-1, A.6.5.5.4.1-2, A.6.5.5.4.1-3, and A.6.5.5.4.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.6.5.5.4.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.6.5.5.4.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.6.5.5.4.1-1: Supported test configurations for FR1 PCell

Configuration	Description
1	FDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
2	TDD duplex mode, 15 kHz SSB SCS, 10 MHz bandwidth
3	TDD duplex mode, 30 kHz SSB SCS, 40 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR1	

Table A.6.5.5.4.1-2: General test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value Test 1	Comment
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		FDD	
	Config 2, 3		TDD	
TDD Configuration	Config 1		Not Applicable	
	Config 2		TDDConf.1.1	
	Config 3		TDDConf..21	
CORESET Reference Channel	Config 1		CR.1.1 FDD	A.3.1.2
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
SSB Configuration	Config 1		SSB.1 FR1	A.3.10
	Config 2		SSB.1 FR1	
	Config 3		SSB.2 FR1	
SMTC Configuration	Config 1, 2		SMTC.1	A.3.11
	Config 3		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		15 KHz	
	Config 3		30 KHz	
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Correlation Matrix and Antenna Configuration			2x2 Low	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.7	A.3.3.7
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1, 2	dBm/SCS kHz	-98	Threshold used for $Q_{in\_LR\_SSB}$

	Config 3		-95	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1	Config 1		CSI-RS.1.2 FDD	A.3.14 .1
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.1.1 FDD	A.3.14.1
	Config 2		CSI-RS.1.1 TDD	
	Config 3		CSI-RS.2.1 TDD	
TRS configuration	Config 1		TRS.1.1 FDD	
	Config 2		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD	
CSI-RS-Index assigned as RLM RS	Config 1		CSI-RS.1.2 FDD	
	Config 2		CSI-RS.1.2 TDD	
	Config 3		CSI-RS.2.2 TDD	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	8.37	
T3		s	6.44	
T4		s	0	
T5		s	1.97	
D1		s	1.93	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.6.5.5.4.1-3: Cell specific test parameters for FR1 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
	Config 3		5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	-10	-10	10	10	10
	Config 2		-10	-10	10	10	10
	Config 3		-10	-10	10	10	10
CSI-RS_RP of set q_1	Config 1	dB/SCS kHz	-110	-110	-88	-88	-88
	Config 2		-110	-110	-88	-88	-88
	Config 3		-107	-107	-85	-85	-85
N_{oc}	Config 1	dBm/15 KHz	-98				
	Config 2		-98				
	Config 3		-98				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.4.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.

Table A.6.5.5.4.1-4: Void

Table A.6.5.5.4.1-5: Void

Table A.6.5.5.4.1-6: Void

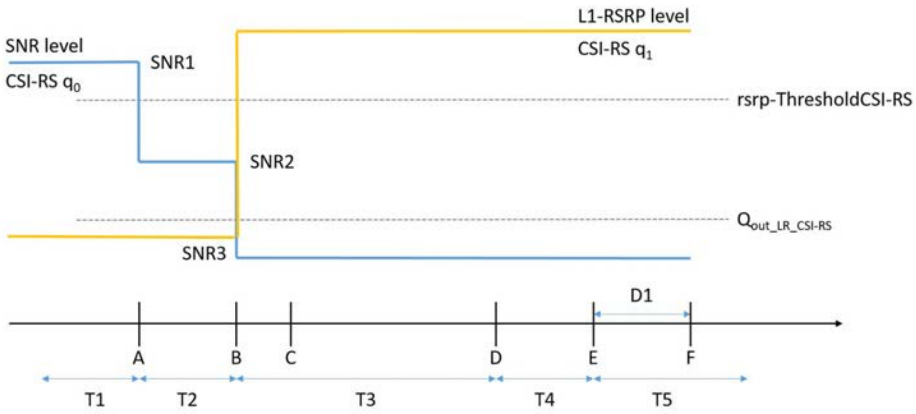


Figure A.6.5.5.4.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.6.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 1920+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.6 Active BWP switch

A.6.5.6.1 DCI-based and Timer-based Active BWP Switch

A.6.5.6.1.1 NR FR1- NR FR1 DL active BWP switch of PCell with non-DRX in SA

A.6.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

The supported test configurations are shown in Table A.6.5.6.1.1.1-1 below. The test scenario comprises of one PCell (Cell 1) and one SCell (Cell 2) as given in Table A.6.5.6.1.1.1-2. NR Cell-specific parameters are specified in Table A.6.5.6.1.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 1 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).
- UE is configured with 2 different UE-specific downlink bandwidth parts for PCell, BWP-1 and BWP-2, in Cell 1 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for SCell, BWP-0 in Cell 2 before starting the test.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 in PCell.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in SCell.
- UE is configured with a *bwp-InactivityTimer* timer value for PCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of PCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PCell no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-2 no later than the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch on PCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PCell (Cell 1).

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of PCell's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the SCell at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-1 no later than the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch of PCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The test equipment verifies that potential interruption to SCell is carried out in the correct time span by monitoring ACK/NACK sent in SCell during BWP switch of PCell, respectively.

Table A.6.5.6.1.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD -FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD – TDD duplex mode
3	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD – FDD duplex mode
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD – TDD duplex mode
5	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD - TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.6.5.6.1.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and SCell
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on SCC.
Cell2 timing offset to cell1	μs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.6.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1	Cell2
Frequency Range			FR1	FR1
Duplex mode	Config 1		FDD	FDD
	Config 2,5		TDD	TDD
	Config 3		TDD	FDD
	Config 4		FDD	TDD
TDD configuration	Config 1		Not Applicable	Not Applicable
	Config 2		TDDConf.1.1	TDDConf.1.1
	Config 3		TDDConf.1.1	Not Applicable
	Config 4		Not Applicable	TDDConf.1.1
	Config 5		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	Config 1,2,3,4		10 MHz: $N_{RB,c}$ = 52	10 MHz: $N_{RB,c}$ = 52
	Config 5		40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106
Active BWP ID			1, 2	0
Initial DL BWP Configuration			DLBWP.0.2[Note4]	
Initial UL BWP Configuration			ULBWP.0.2[Note4]	
Active DL BWP-0 Configuration			N.A.	DLBWP.0.2[Note4]
Active DL BWP-1 Configuration			DLBWP.1.1[Note4]	N.A.
Active DL BWP-2 Configuration			DLBWP.1.3[Note4]	N.A.
Active UL BWP-0 Configuration			N.A.	ULBWP.0.2[Note4]
Active UL BWP-1 Configuration			ULBWP.1.1[Note4]	N.A.
Active UL BWP-2 Configuration			ULBWP.1.3[Note4]	N.A.
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.1.1 FDD
	Config 2		SR.1.1 TDD	SR.1.1 TDD
	Config 3		SR.1.1 TDD	SR.1.1 FDD
	Config 4		SR.1.1 FDD	SR.1.1 TDD
	Config 5		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.1.1 FDD
	Config 2		CR.1.1 TDD	CR.1.1 TDD
	Config 3		CR.1.1 TDD	CR.1.1 FDD
	Config 4		CR.1.1 FDD	CR.1.1 TDD
	Config 5		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.1.1 FDD
	Config 2		CCR.1.1 TDD	CCR.1.1 TDD
	Config 3		CCR.1.1 TDD	CCR.1.1 FDD
	Config 4		CCR.1.1 FDD	CCR.1.1 TDD
	Config 5		CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	
SSB Configuration	Config 1,2,3,4		SSB.1 FR1	
	Config 5		SSB.2 FR1	
SMTC Configuration			SMTC.1	
Correlation Matrix and Antenna Configuration			1x2 Low	
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc}[Note 2]	Config 1,2,3,4	dBm/SCS	-104	-104
	Config 5		-101	-101

N_{oc} Note 2		dBm/15KHz	-104	-104
SS-RSRP Note 3	Config 1,2,3,4	dBm/SCS	-87	-87
	Config 5		-84	-84
$\hat{E}_s/I_{ot}$		dB	17	17
$\hat{E}_s/N_{oc}$		dB	17	17
Io Note3	Config 1,2,3,4	dBm/ 9.36MHz	-58.96	-58.96
	Config 5	dBm/ 38.16MHz	-52.86	-52.86
Propagation Condition			AWGN	AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3 SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].				

A.6.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, $k1$ is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1 and T3, the start time of SCell interruption during PCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first DL slot that occurs after the beginning of DL slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.6.5.6.1.2 NR FR1 DL active BWP switch with non-DRX in SA

A.6.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6.

The supported test configurations are shown in Table A.6.5.6.1.2.1-1. The test scenario comprises of one cell (Cell 1) as given in Table A.6.5.6.1.2.1-2. Cell-specific parameters of the cell are specified in Table A.6.5.6.1.2.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.
- UE is configured with a *bwp-InactivityTimer* timer value for Cell1.

The cell has constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell1's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell1 no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on Cell1.

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the subframe immediately after *bwp-InactivityTimer* timer expires. The UE shall switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell1's slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell1 at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

Table A.6.5.6.1.2.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations. Note 2: A UE which fulfils the requirements in test case A.6.5.6.1.1 can skip the test cases in A.6.5.6.1.2.	

Table A.6.5.6.1.2.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell1 on RF channel number 1.
CP length		Normal	
DRX		OFF	
bwp-InactivityTimer	ms	200	
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.6.5.6.1.2.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1
Frequency Range			FR1
Duplex mode	Config 1		FDD
	Config 2,3		TDD
TDD configuration	Config 1		Not Applicable
	Config 2		TDDConf.1.1
	Config 3		TDDConf.2.1
$BW_{channel}$	Config 1		10 MHz: $N_{RB,c}$ = 52
	Config 2		10 MHz: $N_{RB,c}$ = 52
	Config 3		40 MHz: $N_{RB,c}$ = 106
Active BWP ID			1, 2
Initial DL BWP Configuration	Config 1,2,3		DLBWP.0.2 Note 4
Active DL BWP-1 Configuration	Config 1,2,3		DLBWP.1.1 Note 4
Active DL BWP-2 Configuration	Config 1,2,3		DLBWP.1.3 Note 4
Initial UL BWP Configuration	Config 1,2,3		ULBWP.0.2 Note 4
Active UL BWP-1 Configuration	Config 1,2,3		ULBWP.1.1 Note 4
Active UL BWP-2 Configuration	Config 1,2,3		ULBWP.1.3 Note 4
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD
	Config 2		SR.1.1 TDD
	Config 3		SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD
	Config 2		CR.1.1 TDD
	Config 3		CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD
	Config 2		CCR.1.1 TDD
	Config 3		CCR.2.1 TDD
OCNG Patterns			OP.1
SSB Configuration	Config 1,2		SSB.1 FR1
	Config 3		SSB.2 FR1
SMTC Configuration			SMTC.1
Correlation Matrix and Antenna Configuration			1x2 Low
TRS Configuration	Config 1,4		TRS.1.1 FDD
	Config 2,5		TRS.1.1 TDD
	Config 3,6		TRS.1.2 TDD
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
N_{oc} Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
N_{oc} Note 2		dBm/15kHz	-104
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87

	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io^{Note3}	Config 1,2	dBm/ 9.36MHz	-58.96
	Config 3	dBm/ 38.16MHz	-52.86
Propagation Condition			AWGN
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.6.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed Cell1 active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after beginning of DL slot ($i+T_{BWPswitchDelay}+k1$), ($j+T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.6.5.6.2 RRC-based Active BWP Switch

A.6.5.6.2.1 NR FR1 DL active BWP switch of Cell with non-DRX in SA

A.6.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.

The supported test configurations are shown in Table A.6.5.6.2.1.1-1. The test scenario comprises of one Cell (Cell 1) as given in Table A.6.5.6.2.1.1-2. Cell-specific parameters of Cell are specified in Table A.6.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on Cell 1 to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.

- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in Cell 1.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is completely received at the UE side in PCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot $\mathrm{i}+\frac{T_{\mathrm{RRCprocessingDelay}}+T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$ as defined in clause 8.6.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot $\mathrm{i}+\frac{T_{\mathrm{RRCprocessingDelay}}+T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}+\mathrm{k1}$ on BWP-1 of final condition. The UE shall be continuously scheduled on PCell's BWP-1 of final condition starting from the first DL slot right after slot $\mathrm{i}+\frac{T_{\mathrm{RRCprocessingDelay}}+T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$.

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in Cell by counting the time from the time when the RRC Reconfiguration message including updated BWP configuration is sent till the time when a vaild ACK/NACK is received is received.

Table A.6.5.6.2.1.1-1: DL BWP switch supported test configurations in SA scenario

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.6.5.6.2.1.1-2: General test parameters for DL BWP switch in SA scenario

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	

Table A.6.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in SA scenario

Parameter			Unit	Cell 1
Frequency Range				FR1
Duplex mode		Config 1		FDD
		Config 2,3		TDD
TDD configuration		Config 1		Not Applicable
		Config 2		TDDConf.1.1
		Config 3		TDDConf.2.1
$BW_{channel}$		Config 1		10 MHz: $N_{RB,c}$ = 52
		Config 2		10 MHz: $N_{RB,c}$ = 52
		Config 3		40 MHz: $N_{RB,c}$ = 106
Active BWP ID				1
Initial DL BWP Configuration		Config 1,2, 3		DLBWP.0.2
Initial UL BWP Configuration		Config 1,2, 3		ULBWP.0.2
Initial Condition	Active DL BWP-1 Configuration	Config 1, 2, 3		DLBWP.1.3
	Active UL BWP-1 Configuration	Config 1, 2, 3		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration	Config 1, 2, 3		DLBWP.1.1
	Active UL BWP-1 Configuration	Config 1, 2, 3		ULBWP.1.1
PDSCH Reference measurement channel		Config 1		SR.1.1 FDD
		Config 2		SR.1.1 TDD
		Config 3		SR2.1 TDD
RMSI CORESET parameters		Config 1		CR.1.1 FDD
		Config 2		CR.1.1 TDD
		Config 3		CR2.1 TDD
Dedicated CORESET parameters		Config 1		CCR.1.1 FDD
		Config 2		CCR.1.1 TDD
		Config 3		CCR.2.1 TDD
OCNG Patterns				OP.1
SSB Configuration		Config 1,2		SSB.1 FR1
		Config 3		SSB.2 FR1
SMTC Configuration				SMTC.1
TRS Configuration		Config 1		TRS.1.1 FDD
		Config 2		TRS.1.1 TDD
		Config 3		TRS.1.2 TDD
Antenna Configuration				1x2 Low
Propagation Condition				AWGN
EPRE ratio of PSS to SSS			dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				

EPRE ratio of OCNG to OCNG DMRS(Note 1)			
N_{oc} Note 2	Config 1,2	dBm/SCS	-104
	Config 3		-101
SS-RSRP Note 3	Config 1,2	dBm/SCS	-87
	Config 3		-84
$\hat{E}_s/I_{ot}$		dB	17
$\hat{E}_s/N_{oc}$		dB	17
Io Note3	Config 1,2	dBm/ 9.36MHz	-58.96
	Config 3	dBm/ 38.16MHz	-52.86
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

A.6.5.6.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for the Cell from the first DL slot that occurs right after the begining of slot $\mathrm{i} + \frac{T_{\mathrm{RRCprocessingDelay}} + T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$ and starts to report valid ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot $\mathrm{i} + \frac{T_{\mathrm{RRCprocessingDelay}} + T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}} + \mathrm{k1}$.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed Cell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.7 DL interruptions at switching between two uplink carriers

A.6.5.7.1 DL interruptions at switching between two uplink carriers in FDD-TDD CA

A.6.5.7.1.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink carriers defined in clause 8.2.2.2.10. The test case is applicable for an uplink band pair of an inter-band FDD-TDD CA configuration when the capability *uplinkTxSwitchingPeriod* is present.

There are two cells: FR1 FDD PCell (Cell 1), FR1 TDD SCell (Cell 2). The test parameters for the two cells are given in Table A.6.5.7.1.1-1, Table A.6.5.7.1.1-2 and Table A.6.5.7.1.1-3 below.

For NR FDD carrier (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting [6dB] on the symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 210us or symbol #9 if UE capability *uplinkTxSwitchingPeriod* is 140us or symbol #10 if UE capability *uplinkTxSwitchingPeriod* is 35us in the slot overlapping with the special slot of the NR TDD carrier. For NR TDD carrier (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting [6dB] on the symbol #4 if UE capability *uplinkTxSwitchingPeriod* is 210us or symbol #5 if UE capability *uplinkTxSwitchingPeriod* is 140us or symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 35us in the special slot. This test verifies that the UE correctly report the

L1-RSRP reporting. The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE.

Table A.6.5.7.1.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7.1.1-2: General test parameters for DL interruptions at switching between two uplink carriers in FDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2	Two radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.1.5 FDD Cell 2: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7.1.1-3: Cell specific test parameters for DL interruptions at switching between two uplink carriers in FDD-TDD CA

Parameter		Unit	Cell1	Cell2
Frequency Range			FR1	FR1
Duplex mode	Config 1		FDD	TDD
TDD configuration	Config 1		N/A	TDDConf.2.1 except that: S='10DL:2GP:2UL'; *nrofDownlinkSymbols:10* *nrofUplinkSymbols: 2*
$BW_{channel}$	Config 1		10 MHz: $N_{RB,c}$ = 52	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRS configuration in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0resourceMappingnrofSymbols: n2	SRS configuration in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.1 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		dBm/15 kHz	-104	-104
SS-RSRP Note 3		dBm/15 kHz	-87	-87
$\hat{E}_s/I_{ot}$		dB	17	17
$\hat{E}_s/N_{oc}$		dB	17	17
N_{oc} Note 2	Config 1	dBm/SCS	-104	-101
Io Note3	Config 1	dBm/9.36 MHz	-58.96	-
		dBm/ 38.16MHz	-	-52.86
Time offset to Cell1 Note 5		µs	-	0
Propagation Condition			AWGN	AWGN

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	Void
Note 5:	Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7.1.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.1.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.5.7.2 DL interruptions at switching between two uplink carriers in TDD-TDD CA

A.6.5.7.2.1 Test Purpose and Environment

The purpose of this test is to verify DL interruption requirements during UE dynamic switching between two uplink carriers defined in clause 8.2.2.2.10. The test case is applicable for an uplink band pair of an inter-band TDD-TDD CA configuration when the capability *uplinkTxSwitchingPeriod* is present.

There are two cells: FR1 TDD PCell (Cell 1), FR1 TDD SCell (Cell 2). The test parameters for the two cells are given in Table A.6.5.7.2.1-1, Table A.6.5.7.2.1-2 and Table A.6.5.7.2.1-3 below.

For NR TDD PCell (Cell 1), aperiodic CSI-RS for L1-RSRP reporting is triggered with power boosting [6dB] on the symbol #4 if UE capability *uplinkTxSwitchingPeriod* is 210us or symbol #5 if UE capability *uplinkTxSwitchingPeriod* is 140us or symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 35us on the special slot. For NR TDD SCell (Cell 2), aperiodic CSI-RS for L1-RSRP reporting is configured with power boosting [6dB] on the symbol #4 if UE capability *uplinkTxSwitchingPeriod* is 210us or symbol #5 if UE capability *uplinkTxSwitchingPeriod* is 140us or symbol #8 if UE capability *uplinkTxSwitchingPeriod* is 35us on the 2nd special slot of every 8 slots. This test verifies that the UE correctly report the L1-RSRP reporting. The test case is only applicable to UE which supports *simultaneousRxTxInterBandCA.*

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, *uplinkTxSwitching* is indicated to UE.

Table A.6.5.7.2.1-1: Supported test configurations

Configuration	Description
1	NR Cell 1: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode NR Cell 2: 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode

Table A.6.5.7.2.1-2: General test parameters for DL interruptions at switching between two uplink carriers in TDD-TDD CA

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		Config 1	1, 2	Two radio channels are used for this test.
Active cell		Config 1	Cell 1: FR1 PCell Cell 2: FR1 SCell	FR1 PCell on RF channel number 1 FR1 SCell on RF channel number 2
CP length		Config 1	Normal	
DRX		Config 1	OFF	
Measurement gap pattern Id		Config 1	OFF	
Filter coefficient		Config 1	0	L3 filtering is not used
CSI-RS configuration for L1-RSRP reporting		Config 1	Cell 1: CSI-RS.2.5 TDD Cell 2: CSI-RS.2.5 TDD	
T1	s	Config 1	5	

Table A.6.5.7.2.1-3: Cell specific test parameters for DL interruptions at switching between two uplink carriers in TDD-TDD CA

Parameter		Unit	Cell1	Cell2
Frequency Range			FR1	FR1
Duplex mode	Config 1		TDD	TDD
TDD configuration	Config 1		TDDConf.2.1 except that S='10DL:2GP:2UL'; *nrofDownlinkSymbols:10* *nrofUplinkSymbols: 2*	TDDConf.2.2
$BW_{channel}$	Config 1		40 MHz: $N_{RB,c}$ = 106	40 MHz: $N_{RB,c}$ = 106
Initial BWP Configuration	Config 1		DLBWP.0.1	DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1	DLBWP.1.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1	ULBWP.1.1
SRS configuration	Config 1		SRS configuration in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2	SRS configuration in Table A.4.4.1.1.1-3 is applied except that: resourceMappingstartPosition: 0 resourceMappingnrofSymbols: n2
PDSCH Reference measurement channel	Config 1		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET parameters	Config 1		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET parameters	Config 1		CCR.2.1 TDD	CCR.2.1 TDD
OCNG Patterns			OP.1	OP.1
SMTC Configuration			SMTC.1	SMTC.1
SSB Configuration	Config 1		SSB.2 FR1	SSB.2 FR1
Correlation Matrix and Antenna Configuration			1x2 Low	2x2 Low
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note 2		dBm/15 kHz	-104	-104
SS-RSRP Note 3		dBm/15 kHz	-87	-87
$\hat{E}_s/I_{ot}$		dB	17	17
$\hat{E}_s/N_{oc}$		dB	17	17
N_{oc} Note 2	Config 1	dBm/SCS	-104	-101
Io Note3	Config 1	dBm/9.36 MHz	-58.96	-
		dBm/ 38.16MHz	-	-52.86
Time offset to Cell1 Note 5		µs	-	0
Propagation Condition			AWGN	AWGN

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	Void
Note 5:	Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.

A.6.5.7.2.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.2.2.2.10.

UE shall send L1-RSRP report while meeting the accuracy requirements defined in clause 10.1.19.1.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6 Measurement procedure

A.6.6.1 Intra-frequency Measurements

A.6.6.1.1 SA event triggered reporting tests without gap under non-DRX

A.6.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.1.1.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell and neighbour cell are given in Table A.6.6.1.1.1-1 and A.6.6.1.1.1-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.6.6.1.1.1.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.1.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.6.6.1.1.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS Configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.1.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.2 SA event triggered reporting tests without gap under DRX

A.6.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.1.2.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in Table A.6.6.1.2.2-1, A.6.6.1.2.2-2 and A.6.6.1.2.2-3 below. In the measurement controlinformation, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.1.2.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.2.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3	Cell 1		
Neighbour cell		1, 2, 3	Cell 2		Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2		
SSB configuration		1	SSB.1 FR1		
		2	SSB.1 FR1		
		3	SSB.2 FR1		
SMTC configuration		1	SMTC.2		
		2	SMTC.1		
		3	SMTC.1		
A3-Offset	dB	1, 2, 3	-4.5		
CP length		1, 2, 3	Normal		
Hysteresis	dB	1, 2, 3	0		
Time To Trigger	s	1, 2, 3	0		
Filter coefficient		1, 2, 3	0		L3 filtering is not used
DRX		1, 2, 3	DRX.1	DRX.2	
Time offset between serving and neighbour cells		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3 µs		Synchronous cells
		3	3 µs		Synchronous cells
T1	s	1, 2, 3	5		
T2	s	1, 2, 3	5	10	

Table A.6.6.1.2.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.2.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.3 SA event triggered reporting tests with per-UE gaps under non-DRX

A.6.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.6.6.1.3.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in Table A.6.6.1.3.1-1 and A.6.6.1.3.1-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.6.6.1.3.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.3.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
Measurement gap type		1, 2, 3	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2, 3	40	
Measurement gap length	ms	1, 2, 3	6	
Measurement gap offset	ms	1, 2, 3	39	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0	
		2	CSI-RS.1.2 TDD resource #0	
		3	CSI-RS.2.2 TDD resource #0	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX	ms	1, 2, 3		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	5	

Table A.6.6.1.3.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD		CCR.1.1 FDD	
		2	CCR.1.2 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	--64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.1.3.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.4 SA event triggered reporting tests with per-UE gaps under DRX

A.6.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.6.6.1.4.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in Table A.6.6.1.4.2-1, A.6.6.1.4.2-2 and A.6.6.1.4.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.1.4.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.4.2-2: General test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
Active cell		1, 2, 3	Cell 1		
Neighbour cell		1, 2, 3	Cell 2		Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2		
Measurement gap type		1, 2, 3	Per-UE gaps		
Measurement gap repitition periodicity	ms	1, 2, 3	40		
Measurement gap length	ms	1, 2, 3	6		
Measurement gap offset	ms	1, 2, 3	39		
SSB configuration		1	SSB.1 FR1		
		2	SSB.1 FR1		
		3	SSB.2 FR1		
SMTC configuration		1	SMTC.2		
		2	SMTC.1		
		3	SMTC.1		
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0		
		2	CSI-RS.1.2 TDD resource #0		
		3	CSI-RS.2.2 TDD resource #0		
A3-Offset	dB	1, 2, 3	-4.5		
CP length		1, 2, 3	Normal		
Hysteresis	dB	1, 2, 3	0		
Time To Trigger	s	1, 2, 3	0		
Filter coefficient		1, 2, 3	0		L3 filtering is not used
DRX		1, 2, 3	DRX.1	DRX.2	
Time offset between serving and neighbour cells		1	3 ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 3.
		2	3 µs		Synchronous cells
		3	3 µs		Synchronous cells
T1	s	1, 2, 3	5		
T2	s	1, 2, 3	5	10	

Table A.6.6.1.4.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with per-UE gaps for PCell in FR1 with DRX

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD		CCR.1.1 FDD	
		2	CCR.1.2 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2, 3	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	--58.50	-56.16
Propagation Condition		1, 2, 3	AWGN			

Note 1:	Table A.6.6.1.4.2-1The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2:	Table A.6.6.1.4.2-1Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	Table A.6.6.1.4.2-1SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.1.4.2-4: Void

Table A.6.6.1.4.2-5: Void

A.6.6.1.4.3 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 6400 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.5 SA event triggered reporting tests without gap under non-DRX with SSB index reading

A.6.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2.

A.6.6.1.5.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in Table A.6.6.1.5.2-1 and A.6.6.1.5.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.6.6.1.5.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

Table A.6.6.1.5.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	
Neighbour cell		1	Cell 2	Cell to be identified.
RF Channel Number		1	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
SMTC configuration		1	SMTC.2	
A3-Offset	dB	1	-4.5	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX	ms	1		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
T1	s	1	5	
T2	s	1	5	

Table A.6.6.1.5.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
OCNG Patterns		1	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1	DLBWP.0,1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
N_{oc} Note 2	dBm/15 kHz	1	-98			
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
Propagation Condition		1	AWGN			
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.1.5.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.6 SA event triggered reporting tests with per-UE gaps under non-DRX with SSB index reading

A.6.6.1.6.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the FDD intra-frequency cell search requirements in clause 9.2.6.2 and 9.2.6.3.

A.6.6.1.6.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for FDD PCell and neighbour cell are given in Table A.6.6.1.6.2-1 and A.6.6.1.6.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

Table A.6.6.1.6.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode

Table A.6.6.1.6.2-2: General test parameters for SA intra-frequency event triggered reporting with gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	
Neighbour cell		1	Cell 2	Cell to be identified.
RF Channel Number		1	1: Cell 1 and Cell 2	
Measurement gap type		1	Per-UE gaps	
Measurement gap repitition periodicity	ms	1	40	
Measurement gap length	ms	1	6	
Measurement gap offset	ms	1	39	
SSB configuration		1	SSB.1 FR1	
SMTC configuration		1	SMTC.2	
CSI-RS parameters		1	CSI-RS.1.2 FDD resource #0	
A3-Offset	dB	1	-4.5	
CP length		1	Normal	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX	ms	1		OFF
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
T1	s	1	5	
T2	s	1	5	

Table A.6.6.1.6.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting with gap for FDD PCell in FR1 with SSB index reading

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	N/A		N/A	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
Dedicated CORESET RMC configuration		1	CCR.1.2 FDD		CCR.1.1 FDD	
OCNG Patterns		1	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
IInitial BWP configuration		1	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1	CSI-RS		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
N_{oc} Note 2	dBm/15 kHz	1	-98			
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
Io	dBm/9.36 MHz	1	-64.60	-62.25	--64.60	-62.25
Propagation Condition		1	AWGN			
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.1.6.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.1.7 SA event triggered reporting tests under DRX for UE configured with highSpeedMeasFlag-r16

A.6.6.1.7.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event for UE configured with highSpeedMeasFlag-r16. This test will partly verify the intra-frequency cell search requirements in clauses 9.2.5.1 and 9.2.5.2.

A.6.6.1.7.2 Test parameters

Two cells are deployed in the test, which are FR1 PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for PCell are given in Table A.6.6.1.7.2-1, A.6.6.1.7.2-2 and A.6.6.1.7.2-3 below. In the measurement controlinformation, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.1.7.2-1: Supported test configurations

Configuration	Description
1	15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.6.6.1.7.2-2: General test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Test configuration	Value	Comment
highSpeedMeasFlag-r16		1,2,3	Present	To enable high speed measurement enhancements
Active cell		1, 2, 3	Cell 1	
Neighbour cell		1, 2, 3	Cell 2	Cell to be identified.
RF Channel Number		1, 2, 3	1: Cell 1 and Cell 2	
SSB configuration		1	SSB.1 FR1	
		2	SSB.1 FR1	
		3	SSB.2 FR1	
SMTC configuration		1	SMTC.2	
		2	SMTC.1	
		3	SMTC.1	
A3-Offset	dB	1, 2, 3	-4.5	
CP length		1, 2, 3	Normal	
Hysteresis	dB	1, 2, 3	0	
Time To Trigger	s	1, 2, 3	0	
Filter coefficient		1, 2, 3	0	L3 filtering is not used
DRX		1, 2, 3	DRX.2	640ms DRX cycle
Time offset between serving and neighbour cells		1	3 ms	Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3 µs	Synchronous cells
		3	3 µs	Synchronous cells
T1	s	1, 2, 3	5	
T2	s	1, 2, 3	6	

Table A.6.6.1.7.2-3: NR Cell specific test parameters for SA intra-frequency event triggered reporting without gap for PCell in FR1 with DRX for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1	TN/A		TN/A	
		2	TDDConf.1.1		TDDConf.1.1	
		3	TDDConf.2.1		TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 FDD		N/A	
		2	SR.1.1 TDD			
		3	SR.2.1 TDD			
RMSI CORESET RMC configuration		1	CR.1.1 FDD		CR.1.1 FDD	
		2	CR.1.1 TDD		CR.1.1 TDD	
		3	CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 FDD		CCR.1.1 FDD	
		2	CCR.1.1 TDD		CCR.1.1 TDD	
		3	CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns		1, 2, 3	OP.1		OP.1	
TRS configuration		1	TRS.1.1 FDD		N/A	
		2	TRS.1.1 TDD		N/A	
		3	TRS.1.2 TDD		N/A	
IInitial BWP configuration		1, 2, 3	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2, 3	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2, 3	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2, 3	SSB		SSB	
N_{oc} Note 2	dBm/SCS	1	-98			
		2	-98			
		3	-95			
N_{oc} Note 2	dBm/15 kHz	1	-98			
		2				
		3				
$\hat{E}_s/I_{ot}$	dB	1	4	-1.46	-Infinity	-1.46
		2				
		3				
$\hat{E}_s/N_{oc}$	dB	1	4	4	-Infinity	4
		2				
		3				
SS-RSRP Note 3	dBm/SCS kHz	1	-94	-94	-Infinity	-94
		2	-94	-94	-Infinity	-94
		3	-91	-91	-Infinity	-91
Io	dBm/9.36 MHz	1	-64.60	-62.25	-64.60	-62.25
	dBm/9.36 MHz	2	-64.60	-62.25	-64.60	-62.25
	dBm/38.16 MHz	3	-58.50	-56.16	-58.50	-56.16
Propagation Condition		1, 2	AWGN		AWGN 1944Hz Note 4	
		3	AWGN		AWGN 3334Hz Note 5	

Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944Hz.
Note 5:	The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334Hz.

A.6.6.1.7.3 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 5120 ms from the beginning of time period T2. The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2 Inter-frequency Measurements

A.6.6.2.1 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is not used

A.6.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in Tables A.6.6.2.1.1-1, A.6.6.2.1.1-2 and A.6.6.2.1.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.6.6.2.1.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.6.6.2.1.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.6.6.2.1.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	4	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9	9	
SMTC-SSB parameters		Config 1	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3	SSB.2 FR1		As specified in clause A.3.10.1
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	OFF		DRX is not used
Time offset between serving and neighbour cells		Config 1	3ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	1	1	

Table A.6.6.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{RB,c}$ = 52			
			Config 3	40: $N_{RB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{RB,c}$ = 52			
			Config 3	40: $N_{RB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD			
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.6.6.2.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 760 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.2 SA event triggered reporting tests for FR1 without SSB time index detection when DRX is used

A.6.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in Tables A.6.6.2.2.1-1, A.6.6.2.2.1-2 and A.6.6.2.2.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.6.6.2.2.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #4 as defined in Table A.6.6.2.2.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.2.2.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
NR RF Channel Number		Config 1,2,3	1, 2				Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR cell 1 (Pcell)				NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell2				NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0		4		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9		9		
A3-Offset	dB	Config 1,2,3	-6				
Hysteresis	dB	Config 1,2,3	0				
CP length		Config 1,2,3	Normal				
TimeToTrigger	s	Config 1,2,3	0				
Filter coefficient		Config 1,2,3	0				L3 filtering is not used
DRX		Config 1,2,3	DRX .1	DRX .2	DRX .1	DRX .2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3ms				Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		Config 2,3	3μs				Synchronous cells.
T1	s	Config 1,2,3	5				
T2	s	Config 1,2,3	1.1	11	1.1	11	

Table A.6.6.2.2.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{RB,c}$ = 52			
			Config 3	40: $N_{RB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{RB,c}$ = 52			
			Config 3	40: $N_{RB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP		Config 1, 2, 3	ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD		NA	
			Config 3	SR2.1 TDD		NA	
CORESET Reference Channel			Config 1	CR.1.1 FDD		NA	
			Config 2	CR.1.1 TDD		NA	
			Config 3	CR2.1 TDD		NA	
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							

EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz	Config 1,2,3	-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36MHz	Config 1,2	-64.59	-64.59	-70.05	-62.2
	dBm/38.16MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

Table A.6.6.2.2.1-4: DRX-Configuration for SA inter-frequency event triggered reporting without SSB time index detection

Field	Test1&3	Test2&4	Comment
	Value	Value	
drx-onDurationTimer	ms1	ms1	As specified in clause 6.3.2 in TS 38.331 [2]
drx-InactivityTimer	ms1	ms1	
drx-RetransmissionTimerDL	sl1	sl1	
drx-RetransmissionTimerUL	sl1	sl1	
drx-LongCycleStartOffset	ms40	Ms640	
shortDRX	disable	disable	

Table A.6.6.2.2.1-5: *TimeAlignmentTimer* -Configuration SA inter-frequency event triggered reporting without SSB time index detection

Field	Value	Comment
TimeAlignmentTimer	ms500	As specified in clause 6.3.2 in TS 38.331 [2]

A.6.6.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2, 3 and 4 UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.3 Void

A.6.6.2.4 Void

A.6.6.2.5 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

A.6.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in Tables A.6.6.2.5.1-1, A.6.6.2.5.1-2 and A.6.6.2.5.1-3.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.6.6.2.5.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.6.6.2.5.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.6.6.2.5.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.5.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	4	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9	9	
A3-Offset	dB	Config 1,2,3	-6		
Hysteresis	dB	Config 1,2,3	0		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	OFF		DRX is not used
Time offset between serving and neighbour cells		Config 1	3ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	1.1	1	

Table A.6.6.2.5.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{RB,c}$ = 52			
			Config 3	40: $N_{RB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{RB,c}$ = 52			
			Config 3	40: $N_{RB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD			
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							

EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36MHz	Config 1,2	-64.59	-64.59	-70.05	-62.2
	dBm/38.16MHz	Config 3	-58.4	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.6.6.2.5.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 880 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and 2 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.6 SA event triggered reporting tests for FR1 with SSB time index detection when DRX is used

A.6.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 2. The test parameters are given in Tables A.6.6.2.6.1-1, A.6.6.2.6.1-2 and A.6.6.2.6.1-3.

In test 1&2 measurement gap pattern configuration # 0 as defined in Table A.6.6.2.6.1-2 is provided for UE that does not support per-FR gap and in test 3&4 measurement gap pattern configuration #4 as defined in Table

A.6.6.2.6.1-2 is provided for UE that supports per-FR gap. If a UE supports per-FR gap and gap pattern configuration #4, it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

UE needs to be provided at least once every 500 ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore, UE is allocated with PUSCH resource at every DRX cycle.

Table A.6.6.2.6.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR1

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations Note 2: target NR cell has the same SCS, BW and duplex mode as NR serving cell	

Table A.6.6.2.6.1-2: General test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
NR RF Channel Number		Config 1,2,3	1, 2				Two FR1 NR carrier frequencies is used.
Active cell		Config 1,2,3	NR cell 1 (Pcell)				NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell2				NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0		4		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	9		9		
A3-Offset	dB	Config 1,2,3	-6				
Hysteresis	dB	Config 1,2,3	0				
CP length		Config 1,2,3	Normal				
TimeToTrigger	s	Config 1,2,3	0				
Filter coefficient		Config 1,2,3	0				L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3 ms				Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		Config 2,3	3 μs				Synchronous cells.
T1	s	Config 1,2,3	5				
T2	s	Config 1,2,3	1.3	13.5	1.3	13.5	

Table A.6.6.2.6.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR1 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD			
			Config 2,3	TDD			
TDD configuration			Config 1	Not Applicable			
			Config 2	TDDConf.1.1			
			Config 3	TDDConf.2.1			
$BW_{channel}$		MHz	Config 1,2	10: $N_{RB,c}$ = 52			
			Config 3	40: $N_{RB,c}$ = 106			
BWP BW		MHz	Config 1,2	10: $N_{RB,c}$ = 52			
			Config 3	40: $N_{RB,c}$ = 106			
BWP configuration	Initial DL BWP		Config 1, 2, 3	DLBWP.0.1		NA	
	Initial UL BWP			ULBWP.0.1		NA	
	Dedicated DL BWP			DLBWP.1.1		NA	
	Dedicated UL BWP			ULBWP.1.1		NA	
TRS configuration			Config 1	TRS.1.1 FDD		NA	
			Config 2	TRS.1.1 TDD		NA	
			Config 3	TRS.1.2 TDD		NA	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		NA	
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SSB parameters			Config 1	SSB.1 FR1		SSB.5 FR1	
			Config 2	SSB.1 FR1		SSB.5 FR1	
			Config 3	SSB.2 FR1		SSB.6 FR1	
SMTC configuration defined in A.3.11			Config 1	SMTC.2		SMTC.5	
			Config 2, 3	SMTC.1		SMTC.4	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15			
			Config 3	30			
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							

EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	dBm/15 kHz		-98		-98	
N_{oc} Note2	dBm/SCS	Config 1,2	-98		-98	
		Config 3	-95		-95	
SS-RSRP Note 3	dBm/SCS	Config 1,2	-94	-94	-Infinity	-91
		Config 3	-91	-91	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	4	4	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3	4	4	-Infinity	7
Io Note3	dBm/9.36MHz	Config 1,2	-64.59	-64.59	-70.05	-62.26
	dBm/38.16MHz	Config 3	-58.49	-58.49	-63.94	-56.15
Propagation Condition		Config 1,2,3	AWGN		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.						

A.6.6.2.6.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 13440 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 13440 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1, 2, 3 and 4 UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.2.7 Void

A.6.6.2.8 Void

A.6.6.3 Inter-RAT Measurements

A.6.6.3.1 SA NR - E-UTRAN event-triggered reporting in non-DRX in FR1

A.6.6.3.1.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in Clauses 9.4.2 and 9.4.3.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.6.6.3.1.1-1. General test parameters are provided in Table A.6.6.3.1.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in Tables A.6.6.3.1.1-3 and A.6.6.3.1.1-4, respectively.

Table A.6.6.3.1.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.3.1.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		1	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in Tables A.6.6.3.1.1-2 and A.6.6.3.1.1-3.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 2
Gap Pattern Id		0	As specified in Clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2
b2-Threshold2EUTRA	dBm	-95	E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF
T1	s	5	
T2	s	5	
Note 1: Values are defined in Table A.6.6.3.1.1-3			

Table A.6.6.3.1.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in non-DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 2, 3	FDD	
			4, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.1.2	
$BW_{channel}$		MHz	1, 4	10: $N_{RB,c}$ = 52 (FDD)	
			2, 5	10: $N_{RB,c}$ = 52 (TDD)	
			3, 6	40: $N_{RB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1	
OCNG pattern^{Note1}			1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
b2-Threshold1		dBm	1, 2, 4, 5	--96	
			3, 6	--93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}^{Note2}		dBm/15 KHz	1, 2, 3, 4, 5, 6	-104	
N_{oc}^{Note2}		dBm/SCS	1, 2, 4, 5	-104	
			3, 6	-101	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	116	70
$\hat{E}_s/I_{ot}$^{Note3}		dB	1, 2, 3, 4, 5, 6	116	70
SS-RSRP^{Note3}		dBm/SCS	1, 2, 4, 5	--88	--104
			3, 6	--85	--101
SSB_RP^{Note3}		dBm/SCS	1, 2, 4, 5	--88	--104
			3, 6	--85	--101
Io^{Note3}		dBm/9.36 MHz	1, 2, 4, 5	--59.94	--73.04
		dBm/38.16 MHz	3, 6	--53.84	--66.93
Propagation condition			1, 2, 3, 4, 5, 6	ETDLA30	
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low	

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	$\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.3.1.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2

RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	17
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
Io[Note5]	dBm/9MHz	1, 2, 3, 4, 5, 6	-76.22+10log ($N_{RB,c}$ /50)	-59.13+10log ($N_{RB,c}$ /50)
Propagation Condition		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.6.6.3.1.2 Test Requirements

The UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.3.2 SA NR - E-UTRAN event-triggered reporting in DRX in FR1

A.6.6.3.2.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements when operating in standalone (SA) operation with PCell in FR1 when DRX is used. This test shall partly verify the cell search and measurement requirements in Clauses 9.4.2 and 9.4.3. There are two test cases. In test 1 the UE shall be configured with DRX cycle of 40 ms. In test 2 the UE shall be configured with DRX cycle of 640 ms.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indctated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

In each test the UE shall be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore the UE shall be allocated with PUSCH resource at every DRX cycle.

Supported test configurations are shown in table A.6.6.3.2.1-1. General test parameters are provided in Table A.6.6.3.2.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in Tables A.6.6.3.2.1-3 and A.6.6.3.2.1-4, respectively.

Table A.6.6.3.2.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.3.2.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Test 1	Test 2	Comment
		Value		
NR RF Channel Number		1		1 NR carrier frequency is used in the test
LTE RF Channel Number		2		1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in Tables A.6.6.3.2.1-2 and A.6.6.3.2.1-3.		
Active cell		Cell 1		Cell 1 is on RF channel number 1
Neighbour cell		Cell 2		Cell 2 is on RF channel number 2
Gap Pattern Id		0		As specified in Clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP		Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP		Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1		SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2
b2-Threshold2EUTRA	dBm	-95		E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2
Hysteresis	dB	0		
TimeToTrigger	s	0		
Filter coefficient		0		L3 filtering is not used
DRX		DRX.1	DRX.2	DRX cycle configurations DRX.1 and DRX.2 are defined in Table A.3.3.1-1 and Table A.3.3.2-1 respectively.
T1	s	5		
T2	s	5	15	
Note 1: Values are defined in Table A.6.6.3.2.1-3				

Table A.6.6.3.2.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 2, 3	FDD	
			4, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{RB,c}$ = 52 (FDD)	
			2, 5	10: $N_{RB,c}$ = 52 (TDD)	
			3, 6	40: $N_{RB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1	
OCNG pattern^{Note1}			1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
b2-Threshold1		dBm	1, 2, 4, 5	-96	
			3, 6	-93	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}^{Note2}		dBm/15 KHz	1, 2, 3, 4, 5, 6	-104	
N_{oc}^{Note2}		dBm/SCS	1, 2, 4, 5	-104	
			3, 6	-101	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	16	16
$\hat{E}_s/I_{ot}$^{Note3}		dB	1, 2, 3, 4, 5, 6	16	16
SS-RSRP^{Note3}		dBm/SCS	1, 2, 4, 5	-88	-88
			3, 6	-85	-85
SSB_RP^{Note3}		dBm/SCS	1, 2, 4, 5	-88	-88
			3, 6	-85	-85
Io^{Note3}		dBm/9.36 MHz	1, 2, 4, 5	-59.94	-59.94
		dBm/38.16 MHz	3, 6	-53.84	-53.84
Propagation condition			1, 2, 3, 4, 5, 6	ETDLA30	
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low	

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	$\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.3.2.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	-Infinity
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	-Infinity
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-Infinity
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-Infinity
Io[Note5]	dBm/9MHz	1, 2, 3, 4, 5, 6	-76.22+10log ($N_{RB,c}$ /50)	-76.22+10log ($N_{RB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1:	Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2:	DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3:	OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5:	$\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 6:	Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.6.6.3.2.2 Test Requirements

In test 1, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 3.84s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

In test 2, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 12.8s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.3.3 SA NR - E-UTRAN event-triggered reporting in DRX in FR1 for UE configured with highSpeedMeasFlag-r16

A.6.6.3.3.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT E-UTRAN measurements for UE configured with highSpeedMeasFlag-r16 in standalone (SA) operation with PCell in FR1 when DRX is used. This test shall partly verify the cell search and measurement requirements in Clauses 9.4.2 and 9.4.3.

In the test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT E-UTRAN inter-RAT neighbour cell. In the measurement control information from the PCell it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

The UE shall be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furthermore the UE shall be allocated with PUSCH resource at every DRX cycle.

Supported test configurations are shown in table A.6.6.3.3.1-1. General test parameters are provided in Table A.6.6.3.3.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in Tables A.6.6.3.3.1-3 and A.6.6.3.3.1-4, respectively.

Table A.6.6.3.3.1-1: Supported test configurations in SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1 for UE configured with highSpeedMeasFlag-r16

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.3.3.1-2: General test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1 for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
LTE RF Channel Number		2	1 LTE carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in Tables A.6.6.3.3.1-2 and A.6.6.3.3.1-3.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 2
Gap Pattern Id		0	As specified in Clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT E-UTRAN measurement quantity		RSRP	Measurement quantity for Cell 2
b2-Threshold1	dBm	Note 1	SS-RSRP threshold for SS-RSRP measurement on cell1 for event B2
b2-Threshold2EUTRA	dBm	-97	E-UTRAN RSRP threshold for SS-RSRP measurement on cell1 for event B2
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		DRX.6	DRX cycle configurations DRX.6 is defined in Table A.3.3.1-6.
T1	s	5	
T2	s	5	
Note 1: Values are defined in Table A.6.6.3.3.1-3			

Table A.6.6.3.3.1-3: PCell specific test parameters for SA inter-RAT E-UTRA event triggered reporting in DRX with PCell in FR1 for UE configured with highSpeedMeasFlag-r16

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3, 4, 5, 6	1	
Duplex mode			1, 2, 3	FDD	
			4, 5, 6	TDD	
TDD Configuration	SCS=15 KHz		2, 5	TDDConf.1.1	
	SCS=30 KHz		3, 6	TDDConf.2.1	
$BW_{channel}$		MHz	1, 4	10: $N_{RB,c}$ = 52 (FDD)	
			2, 5	10: $N_{RB,c}$ = 52 (TDD)	
			3, 6	40: $N_{RB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1, 4	SR.1.1 FDD	
			2, 5	SR.1.1 TDD	
			3, 6	SR.2.1 TDD	
CORSET reference channel			1, 4	CR.1.1 FDD	
			2, 5	CR.1.1 TDD	
			3, 6	CR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3, 4, 5, 6	DLBWP.1.1	
	Initial UL BWP		1, 2, 3, 4, 5, 6	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3, 4, 5, 6	ULBWP.1.1	
OCNG pattern^{Note1}			1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration			1, 2, 4, 5	SSB.1 FR1	
			3, 6	SSB.2 FR1	
b2-Threshold1		dBm	1, 2, 4, 5	-98	
			3, 6	-95	
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}^{Note2}		dBm/15 KHz	1, 2, 3, 4, 5, 6	-106	
N_{oc}^{Note2}		dBm/SCS	1, 2, 4, 5	-106	
			3, 6	-103	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	18	-2
$\hat{E}_s/I_{ot}^{Note3}$		dB	1, 2, 3, 4, 5, 6	18	-2
SS-RSRP^{Note3}		dBm/SCS	1, 2, 4, 5	-88	-108
			3, 6	-85	-105
SSB_RP^{Note3}		dBm/SCS	1, 2, 4, 5	-88	-108
			3, 6	-85	-105
Io^{Note3}		dBm/9.36 MHz	1, 2, 4, 5	-59.98	-75.92
		dBm/38.16 MHz	3, 6	-53.88	-69.82
Propagation condition			1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low	

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	$\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.3.3.1-4: E-UTRAN neighbour cell specific test parameters for SA inter-RAT E-UTRAN event triggered reporting in DRX with PCell in FR1 for UE configured with highSpeedMeasFlag-r16

Parameter	Unit	Configuration	Cell 2	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	2	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-106	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	19
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	-Infinity	19
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-Infinity	-87
Io[Note5]	dBm/9MHz	1, 2, 3, 4, 5, 6	-78.22+10log ($N_{RB,c}$ /50)	-59.16+10log ($N_{RB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6	AWGN1944	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1:	Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2:	DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3:	OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5:	$\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 6:	Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

A.6.6.3.3.2 Test Requirements

In the test, the UE shall send one Event B2 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 4.8s from the start of period T2. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.4 L1-RSRP measurement for beam reporting

A.6.6.4.1 SSB based L1-RSRP measurement when DRX is not used

A.6.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in Table A.6.6.4.1.1-1.

Table A.6.6.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.1.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.6.4.1.2-1 and Table A.6.6.4.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.6.6.4.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52
	2		10: $N_{RB,c}$ = 52
	3		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
OCNG Patterns	1~3		OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~3		Off
reportConfigType	1~3		periodic
reportQuantity	1~3		ssb-Index-RSRP
Number of reported RS	1~3		2
L1-RSRP reporting period	1~3	slot	80
T1	1~3	s	5
T2	1~3	s	1
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.6.6.4.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	-Infinity	3
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.4.1.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.2 SSB based L1-RSRP measurement when DRX is used

A.6.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in Table A.6.6.4.2.1-1.

Table A.6.6.4.2.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.2.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.6.4.2.2-1 and Table A.6.6.4.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.6.6.4.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52
	2		10: $N_{RB,c}$ = 52
	3		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
OCNG Patterns	1~3		OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~3		DRX.3
reportConfigType	1~3		periodic
reportQuantity	1~3		ssb-Index-RSRP
Number of reported RS	1~3		2
L1-RSRP reporting period	1~3	slot	80
T1	1~3	s	5
T2	1~3	s	1
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN

Note 1:	OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.6.6.4.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	-Infinity	3
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.4.2.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than 640ms plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI$_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.3 CSI-RS based L1-RSRP measurement when DRX is not used

A.6.6.4.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in Table A.6.6.4.3.1-1.

Table A.6.6.4.3.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.3.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.6.4.3.2-1 and Table A.6.6.4.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in Table A.6.6.4.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.6.6.4.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52
	2		10: $N_{RB,c}$ = 52
	3		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
CSI-RS configuration	1		CSI-RS 1.3 FDD
	2		CSI-RS 1.3 TDD
	3		CSI-RS 2.3 TDD
OCNG Patterns	1~3		OP.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
DRX configuration	1~3		Off
reportConfigType	1~3		aperiodic
reportQuantity	1~3		cri-RSRP
Number of reported RS	1~3		2
qcl-Info	1~3		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~3	slots	26
T1	1~3	s	5
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			

Propagation condition	1~3		AWGN
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.6.6.4.3.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~3	dBm/15kHz	-94.65	
N_{oc} Note1	1,2	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s/I_{ot}$	1~3	dB	0	3
CSI-RS RSRP Note2	1,2	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	3
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.6.4.3.3 Test Requirements

After 80ms from the beginning of the test, the UE shall send L1-RSRP report at slot 26 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.20.1.1 and relative accuracy requirement in clause 10.1.20.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.4 CSI-RS based L1-RSRP measurement when DRX is used

A.6.6.4.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in Table A.6.6.4.4.1-1.

Table A.6.6.4.4.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.4.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.6.4.4.2-1 and Table A.6.6.4.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 80ms from the beginning of the test, the DCI trigger comes in slot n (1 Config 1,2 and 8 for Config 3) of a frame and UE provides the report back based on the reporting configuration as defined in Table A.6.6.4.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.6.6.4.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52
	2		10: $N_{RB,c}$ = 52
	3		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
CSI-RS configuration	1		CSI-RS 1.3 FDD
	2		CSI-RS 1.3 TDD
	3		CSI-RS 2.3 TDD
OCNG Patterns	1~3		OP.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
DRX configuration	1~3		DRX.3
reportConfigType	1~3		aperiodic
reportQuantity	1~3		cri-RSRP
Number of reported RS	1~3		2
qcl-Info	1~3		SSB#0 for resource#0
			SSB#1 for resource#1
reportSlotOffsetList	1~3	slots	26
T1	1~3	s	5
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~3		AWGN

Note 1:	OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.6.6.4.4.2-2: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
N_{oc} Note1	1~3	dBm/15kHz	-94.65	
N_{oc} Note1	1,2	dBm/SSB SCS	-94.65	
	3		-91.65	
$\hat{E}_s/I_{ot}$	1~3	dB	0	3
CSI-RS RSRP Note2	1,2	dBm/SSB SCS	-94.65	-91.65
	3		-91.65	-88.65
Io Note2	1,2	dBm/9.36 MHz	-63.69	-61.93
	3	dBm/38.16 MHz	-57.59	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	3
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.				

A.6.6.4.4.3 Test Requirements

After 80ms from the beginning of the test, the UE shall send L1-RSRP report at slot 26 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the absolute accuracy requirement in clause 10.1.20.1.1 and relative accuracy requirement in clause 10.1.20.1.2.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.4.5 SSB based L1-RSRP measurement when DRX is used for UE configured with *highSpeedMeasFlag-r16*

A.6.6.4.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement when UE is configured with *highSpeedMeasFlag-r16*. This test will partly verify the L1-RSRP measurement requirements for UE configured with *highSpeedMeasFlag-r16* in clause 9.5.4.1, with the testing configurations for NR cells in Table A.6.6.4.5.1-1.

Table A.6.6.4.5.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.6.6.4.5.2 Test parameters

There is one cells in the test, the FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.6.4.5.2-1 and Table A.6.6.4.5.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.6.6.4.5.2-1: General test parameters for UE configured with *highSpeedMeasFlag-r16*

Parameter	Config	Unit	Value
SSB GSCN	1~3		freq1
Duplex mode	1		FDD
	2		TDD
	3		TDD
TDD Configuration	1		N/A
	2		TDDConf.1.1
	3		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52
	2		10: $N_{RB,c}$ = 52
	3		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD
	2		SR.1.1 TDD
	3		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD
	2		CR.1.1 TDD
	3		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD
	2		CCR.1.1 TDD
	3		CCR.2.1 TDD
SSB configuration	1		SSB.3 FR1
	2		SSB.3 FR1
	3		SSB.4 FR1
OCNG Patterns	1~3		OP.1
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1
TRS Configuration	1		TRS.1.1 FDD
	2		TRS.1.1 TDD
	3		TRS.1.2 TDD
DRX configuration	1~3		DRX.8
reportConfigType	1~3		periodic
reportQuantity	1~3		ssb-Index-RSRP
Number of reported RS	1~3		2
L1-RSRP reporting period	1~3	slot	80
T1	1~3	s	5
T2	1~3	s	2
EPRE ratio of PSS to SSS	1~3	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN 1944 Hz
	3		AWGN 3334 Hz

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Table A.6.6.4.5.2-2: SSB specific test parameters for UE configured with *highSpeedMeasFlag-r16*

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
N_{oc} Note2	1~3	dBm/15kHz	-94.65			
N_{oc} Note2	1,2	dBm/SSB SCS	-94.65			
	3		-91.65			
$\hat{E}_s/I_{ot}$	1~3	dB	0	0	-Infinity	3
SSB RSRP Note3	1,2	dBm/SSB SCS	-94.65	-94.65	-Infinity	-91.65
	3		-91.65	-91.65	-Infinity	-88.65
Io Note3	1,2	dBm/9.36 MHz	-63.69	-63.69	-66.70	-61.93
	3	dBm/38.16 MHz	-57.59	-57.59	-60.61	-55.84
$\hat{E}_s/N_{oc}$	1~3	dB	0	0	-Infinity	3
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.						

A.6.6.4.5.3 Test Requirements

The UE shall send L1-RSRP report every 80 slots. No later than [1920ms] plus 80 slots from the beginning of time period T2, UE shall send L1-RSRP report including results of both SSB0 and SSB1 while meeting the absolute accuracy requirement in clause 10.1.19.1.1 and relative accuracy requirement in clause 10.1.19.1.2. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.5

A.6.6.5.1 SA NR - UTRAN FDD event-triggered reporting in non-DRX in FR1

A.6.6.5.1.1 Test Purpose and Environment

The purpose of this set of tests is to verify that the UE makes correct event-triggered reporting of inter-RAT UTRAN FDD measurements when operating in standalone (SA) operation with PCell in FR1. This test shall partly verify the cell search and measurement requirements in Clause 9.4.6.

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an inter-RAT UTRAN FDD neighbour cell. In the measurement control information from the PCell it is indictated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold2) is to be used. Each test consists of two consecutive time periods, with durations T1 and T2, respectively. Prior to the start of time duration T1, the UE shall be fully synchronized to Cell 1. During T1, the UE shall not have any information on Cell 2.

Supported test configurations are shown in table A.6.6.5.1.1-1. General test parameters are provided in Table A.6.6.5.1.1-2 below. Test parameters for Cell 1 and Cell 2, valid for both time duration T1 and T2, are provided in Tables A.6.6.5.1.1-3 and A.6.6.5.1.1-4, respectively.

Table A.6.6.5.1.1-1: Supported test configurations in SA inter-RAT UTRAN FDD event triggered reporting in non-DRX with PCell in FR1

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, UTRA FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, UTRA FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, UTRA FDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.6.5.1.1-2: General test parameters for SA inter-RAT UTRAN FDD event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Value	Comment
NR RF Channel Number		1	1 NR carrier frequency is used in the test
UTRA RF Channel Number		1	1 UTRA carrier frequency is used in the test
Channel Bandwidth	MHz	As specified in Tables A.6.6.5.1.1-2 and A.6.6.5.1.1-3.	
Active cell		Cell 1	Cell 1 is on RF channel number 1
Neighbour cell		Cell 2	Cell 2 is on RF channel number 2
Gap Pattern Id		0	As specified in Clause Table 9.1.2-1. Per-UE gap pattern.
NR measurement quantity		SS-RSRP	Measurement quantity for Cell 1
Inter-RAT UTRA measurement quantity		CPICH Ec/Io	Measurement quantity for Cell 2
b1-Threshold2UTRA	dB	-16.5	CPICH Ec/Io threshold for SS-RSRP measurement on cell1 for event B1
Hysteresis	dB	0	
TimeToTrigger	s	0	
Filter coefficient		0	L3 filtering is not used
DRX		OFF	OFF
T1	s	5	
T2	s	5	
Note 1: Values are defined in Table A.6.6.5.1.1-3			

Table A.6.6.5.1.1-3: PCell specific test parameters for SA inter-RAT UTRAN FDD event triggered reporting in non-DRX with PCell in FR1

Parameter		Unit	Configuration	Cell 1	
				T1	T2
RF channel number			1, 2, 3	1	
Duplex mode			1, 2, 3	FDD	
TDD Configuration	SCS=15 KHz		2	TDDConf.1.1	
	SCS=30 KHz		3	TDDConf.1.2	
$BW_{channel}$		MHz	1	10: $N_{RB,c}$ = 52 (FDD)	
			2	10: $N_{RB,c}$ = 52 (TDD)	
			3	40: $N_{RB,c}$ = 106 (TDD)	
PDSCH reference measurement channel			1	SR.1.1 FDD	
			2	SR.1.1 TDD	
			3	SR.2.1 TDD	
CORSET reference channel			1	CR.1.1 FDD	
			2	CR.1.1 TDD	
			3	CR.2.1 TDD	
BWP configurations	Initial DL BWP		1, 2, 3	DLBWP.0.1	
	Dedicated DL BWP		1, 2, 3	DLBWP.1.1	
	Initial UL BWP		1, 2, 3	ULBWP.0.1	
	Dedicated UL BWP		1, 2, 3	ULBWP.1.1	
OCNG pattern[Note1]			1, 2, 3	OP.1	
SMTC configuration			1, 2, 3	SMTC.1	
SSB configuration			1, 2	SSB.1 FR1	
			3	SSB.2 FR1	
b2-Threshold1		dBm	1, 2	-98	
			3	-95	
EPRE ratio of PSS to SSS		dB	1, 2, 3	0	
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS					
EPRE ratio of OCNG to OCNG DMRS					
N_{oc}[Note2]		dBm/15 KHz	1, 2, 3	-106	
N_{oc}[Note2]		dBm/SCS	1, 2	-106	
			3	-103	
$\hat{E}_s/N_{oc}$		dB	1, 2, 3	18	-2
$\hat{E}_s/I_{ot}$[Note3]		dB	1, 2, 3	18	-2
SS-RSRP[Note3]		dBm/SCS	1, 2	-88	-108
			3	-85	-105
SSB_RP[Note3]		dBm/SCS	1, 2	-88	-108
			3	-85	-105
Io[Note3]		dBm/9.36 MHz	1, 2	-59.98	-75.92
		dBm/38.16 MHz	3	-53.88	-69.82
Propagation condition			1, 2, 3	ETDLA30	
Antenna Configuration and Correlation Matrix			1, 2, 3	1x2 Low	

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	$\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.5.1.1-4: UTRAN neighbour cell specific test parameters for SA inter-RAT UTRAN FDD event triggered reporting in non-DRX with PCell in FR1

Parameter	Unit	Cell 2	
		T1	T2
UTRA RF Channel Number		1	
CPICH_Ec/Ior	dB	-10	
PCCPCH_Ec/Ior	dB	-12	
SCH_Ec/Ior	dB	-12	
PICH_Ec/Ior	dB	-15	
DPCH_Ec/Ior	dB	N/A	
OCNS		-0.941	
$\hat{I}_{or}/I_{oc}$	dB	-Infinity	-1.8
I_{oc}	dBm/3.84 MHz	-70	
CPICH_Ec/Io	dB	-Infinity	-14
Propagation Condition		AWGN	
Note 1: The DPCH level is controlled by the power control loop. Note 2: The power of the OCNS channel that is added shall make the total power from the cell to be equal to I_{or}.			

A.6.6.5.1.2 Test Requirements

The UE shall send one Event B1 triggered measurement report for Cell 2 to the PCell, with a measurement reporting delay less than 2.4s from the start of period T2, i.e. when Cell 2 becomes detectable. The measurement reporting delay is defined as the time from the beginning of time period T2 to the moment when the UE sends the measurement report on PUSCH.

The UE shall not send event-triggered measurement reports as long as the reporting criteria is not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

A.6.6.6 CLI measurements

A.6.6.6.1 SRS-RSRP measurement with DRX

A.6.6.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SRS-RSRP measurement. This test will verify the SRS-RSRP measurement requirements in clause 9.7.2.5 with the testing configurations for NR cells in Table A.6.6.6.1.1-1.

Table A.6.6.6.1.1-1: Applicable NR configurations for FR1 SRS-RSRP test

Configuration	Description
1	NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.6.6.6.1.2 Test Parameters

One cell is deployed in the test, which is FR1 PCell (Cell 1). The test parameters for PCell is given in Table A.6.6.6.1.2-1 and A.6.6.6.1.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in Table A.6.6.6.1.2-4 and the test parameters for the (virtual) neighbour cell UE in Table A. 6.6.6.1.2-3. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 1 data symbol before SRS to be transmitted.

Table A.6.6.6.1.2-1: General test parameters for SRS-RSRP event triggered reporting for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	Cell 1	
RF Channel Number		1, 2	1: Cell 1	
SSB configuration		1	SSB.1 FR1	
		2	SSB.2 FR1	
SMTC configuration		1	SMTC.1	
		2	SMTC.1	
SRS configuration		1	SRSConf.1	Table A.6.6.6.1.2-3
		2	SRSConf.2	
CP length		1, 2	Normal	
i1-Threshold	dBm	1	-97	
		2	-95	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	DRX.7	
Time offset between DL from serving cell and SRS from test system	µs	1,2	17.67	
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.6.6.6.1.2-2: NR Cell specific test parameters for SRS-RSRP event triggered reporting for PCell in FR1

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1	TDDConf.1.1	
		2	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 TDD	
		2	SR.2.1 TDD	
RMSI CORESET RMC configuration		1	CR.1.1 TDD	
		2	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 TDD	
		2	CCR.2.1 TDD	
OCNG Patterns		1, 2	OP.1	
TRS Configuration		1	TRS.1.1 TDD	
		2	TRS.1.2 TDD	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1	
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-95	
Propagation Condition		1, 2	AWGN	
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

Table A.6.6.6.1.2-3: NR Cell specific test parameters for SRS-RSRP event triggered reporting for neighbour cell UE

Parameter	Unit	Test configuration	Neighbour cell UE	
			T1	T2
N_{oc} Note 2	dBm/15 kHz	1	-98	
		2		
N_{oc} Note 2	dBm/SCS	1	-98	
		2	-95	
$\hat{E}_s/I_{ot}$	dB	1	-infinity	4
		2		
$\hat{E}_s/N_{oc}$	dB	1	-infinity	4
		2		
SRS-RSRP Note 3	dBm/SCS kHz	1	-infinity	-94
		2	-infinity	-91
Io	dBm/9.36 MHz	1	-70.05	-64.59
	dBm/38.16 MHz	2	-63.96	-58.50
Propagation Condition		1, 2	AWGN	

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.6.6.1.2-4: SRS configuration for measurement reporting

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	12	12	
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset	sl640, 4	sl640, 9	
	sequenceId	0	0	Any 10 bit number

A.6.6.6.1.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 1920 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.6.6.2 CLI-RSSI measurement with DRX

A.6.6.6.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of CLI-RSSI measurement. This test will verify the CLI-RSSI measurement requirements in clause 9.7.3.5 with the testing configurations for NR cells in Table A.6.6.6.2.1-1.

Table A.6.6.6.2.1-1: Applicable NR configurations for FR1 CLI-RSSI test

Configuration	Description
1	NR 15 kHz SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30 kHz SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.6.6.6.2.2 Test Parameters

One cell is deployed in the test, which are FR1 PCell (Cell 1). The test parameters for PCell is given in Table A.6.6.6.2.2-1 and A.6.6.6.2.2-2 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI measurement resource and on 1 data symbol before. The CLI-RSSI measurement resource configuration is in Table A.6.6.6.2.2-3.

Table A.6.6.6.2.2-1: General test parameters for CLI-RSSI event triggered reporting for PCell in FR1

Parameter	Unit	Test configuration	Value	Comment
Active cell		1, 2	NR Cell 1	
RF Channel Number		1, 2	1: Cell 1	
SSB configuration		1	SSB.1 FR1	
		2	SSB.2 FR1	
SMTC configuration		1	SMTC.1	
		2	SMTC.1	
CLI-RSSI configuration		1	CLI-RSSIConf.1	Table A.6.6.6.2.2-3
		2	CLI-RSSIConf.2	
CP length		1, 2	Normal	
i1-Threshold	dBm	1	-93	
		2	-93	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	DRX.7	
Time offset between DL from serving cell and OCNG from test system	µs	1,2	17.67	
T1	s	1, 2	5	
T2	s	1, 2	2	

Table A.6.6.6.2.2-2: NR Cell specific test parameters for CLI-RSSI event triggered reporting for PCell in FR1

Parameter	Unit	Test configuration	Cell 1	
			T1	**T2**
TDD configuration		1	TDDConf.1.1	
		2	TDDConf.2.1	
PDSCH RMC configuration		1	SR.1.1 TDD	
		2	SR.2.1 TDD	
PUSCH parameters		1	N/A	
		2		
RMSI CORESET RMC configuration		1	CR.1.1 TDD	
		2	CR.2.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.1.1 TDD	
		2	CCR.2.1 TDD	
OCNG Patterns Note 3		1, 2	OP.1	
TRS Configuration		1	TRS.1.1 TDD	
		2	TRS.1.2 TDD	
Initial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1	
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/15 kHz	1	-116	-108
		2		
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/SCS	1	-116	-108
		2	-113	-105
Io on CLI-RSSI measurement resource	dBm/9.36 MHz	1	-88.05	-80.05
	dBm/38.16 MHz	2	-81.96	-74.00
Io on CLI-RSSI measurement resource	dBm/1.08 MHz	1	-97.43	-89.43
	dBm/1.08 MHz	2	-97.44	-89.44
Propagation Condition		1, 2	AWGN	
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.6.6.6.2.2-3: CLI-RSSI measurement resource configuration for measurement reporting

	Field	CLI-RSSIConf.1	CLI-RSSIConf.2
RSSI-Resource	rssi-ResourceId	0	0
	rssi-SCS	15	30
	startPRB	0	0
	nrofPRBs	52	106
	startPosition	3	3
	nrofSymbols	11	11
	rssi-PeriodicityAndOffset	sl640, 4	sl640, 9

A.6.6.6.2.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 640 ms from the beginning of time period T2. The nominal RSSI used to evaluate the requirement shall be based on Io.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.6.7 Measurement Performance requirements

A.6.7.1 SS-RSRP

A.6.7.1.1 SA: intra-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.2.1.1 and 10.1.2.1.2 for intra-frequency measurements.

A.6.7.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in table A.6.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in A.6.7.1.1.2-2. In all test cases, Cell 1 is the PCell, and Cell 2 is the target cell.

Table A.6.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

Table A.6.7.1.1.2-2: SS-RSRP Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Cell ID			489	0	489	0	489	0
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52					
	Config 2		10: $N_{RB,c}$ = 52					
	Config 3		40: $N_{RB,c}$ = 106					
BWP BW	Config 1		10: $N_{RB,c}$ = 52					
	Config 2		10: $N_{RB,c}$ = 52					
	Config 3		40: $N_{RB,c}$ = 106					
Downlink initial BWP configuration			DLBWP.0.1					
Downlink dedicated BWP configuration			DLBWP.1.1					
Uplink initial BWP configuration			ULBWP.0.1					
Uplink dedicated BWP configuration			ULBWP.1.1					
TRS configuration	Config 1		TRS.1.1 FDD	NA	TRS.1.1 FDD	NA	TRS.1.1 FDD	NA
	Config 2		TRS.1.1 TDD	NA	TRS.1.1 TDD	NA	TRS.1.1 TDD	NA
	Config 3		TRS.1.2 TDD	NA	TRS.1.2 TDD	NA	TRS.1.2 TDD	NA
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Control channel RMC	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
SSB configuration	Config 1		SSB 1 FR1	-	SSB 1 FR1	-	SSB 1 FR1	-
	Config 2		SSB 1 FR1		SSB 1 FR1		SSB 1 FR1	
	Config 3		SSB 2 FR1		SSB 2 FR1		SSB 2 FR1	
SSB configuration	Config 1		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 2		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
	Config 3		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
Time offset with Cell 1	Config 1	ms	-	3	-	3	-	3
	Config 2,3	µs	-	3	-	3	-	3
SMTC configuration	Config 1		SMTC.2					

		Config 2,3		SMTC.1					
OCNG Patterns				OCNG pattern 1					
PDSCH/PDCCH subcarrier spacing		Config 1,2	kHz	15 kHz					
		Config 3		30kHz					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15KhZ	-106		-88		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable[Note 5]		-94		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
N_{oc} Note2	Config 1,2		dBm/SCS	-106		-88		Same as Noc/15kHz	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable[Note 5]		-91		-111	
		NR_FDD_FR1_B						-110.5	
		NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
$\hat{E}_s/I_{ot}$			dB	2.46	-5.97	2.46	-5.97	-0.01	-4.76
$\hat{E}_s/N_{oc}$			dB	6	1	6	1	3	0
SS-RSRP[Note3]	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-100	-105	-82	-87	-111.00	-114.00

		NR_FDD_FR1_B						-110.50	-113.50
		NR_TDD_FR1_C						-110.00	-113.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.50	-112.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109.00	-112.00
		NR_FDD_FR1_F						-108.50	-111.50
		NR_FDD_FR1_G						-108.00	-111.00
		NR_FDD_FR1_H						-107.50	-110.50
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		Not applicable[Note 5]	Not applicable[Note 5]	-85	-90	-108.00	-111.00
		NR_FDD_FR1_B						-107.50	-110.50
		NR_TDD_FR1_C						-107.00	-110.00
		NR_FDD_FR1_D, NR_TDD_FR1_D						-106.50	-109.50
		NR_FDD_FR1_E, NR_TDD_FR1_E						-106.00	-109.00
		NR_FDD_FR1_F						-105.50	-108.50
		NR_FDD_FR1_G						-105.00	-108.00
		NR_FDD_FR1_H						-104.50	-107.50
Io[Note3]	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/9.36MHz	-70.09		-52.09		-80.03	
		NR_FDD_FR1_B						-79.53	
		NR_TDD_FR1_C						-79.03	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-78.53	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-78.03	
		NR_FDD_FR1_F						-77.53	
		NR_FDD_FR1_G						-77.03	
		NR_FDD_FR1_H						-76.53	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/38.16MHz	Not applicable[Note 5]-		-51.99		-73.94	
		NR_FDD_FR1_B						-73.44	
		NR_TDD_FR1_C						-72.94	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-72.44	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-71.94	
		NR_FDD_FR1_F						-71.44	
		NR_FDD_FR1_G						-70.94	
		NR_FDD_FR1_H						-70.44	
Propagation condition			-	AWGN					
Antenna configuration				1x2					

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5:	Subtest 1 is not used when testing with 30kHz SSB SCS.
Note 6:	The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification

A.6.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for cell 1 and cell 2 shall fulfil absolute requirement in clause 10.1.2.1.1 and relative requirement in clause 10.1.2.1.2.

A.6.7.1.2 SA inter-frequency case measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.4.1.1 and 10.1.4.1.2 for inter-frequency measurements with the testing configurations for NR cells in Table A.6.7.1.2.1-1.

Table A.6.7.1.2.1-1: Applicable NR configurations for FR1 inter-frequency SS-RSRP accuracy test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.1.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR1 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.6.7.1.2.2-1 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in Table A.6.7.1.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.6.7.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1~3		freq1	freq2	freq1	freq2
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52		10: $N_{RB,c}$ = 52	
	2		10: $N_{RB,c}$ = 52		10: $N_{RB,c}$ = 52	
	3		40: $N_{RB,c}$ = 106		40: $N_{RB,c}$ = 106	
Duplex mode	1		FDD		FDD	
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A		N/A	
	2		TDDConf.1.1		TDDConf.1.1	
	3		TDDConf.2.1		TDDConf.2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1		SSB.1 FR1	
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1		OP.1	
TRS configuration	1		TRS.1.1 FDD	-	TRS.1.1 FDD	
	2		TRS.1.1 TDD		TRS.1.1 TDD	
	3		TRS.1.2 TDD		TRS.1.2 TDD	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1		DLBWP.1.1 ULBWP.1.1	
Time offset with Cell 1	1	ms	-	3	-	3
	2,3	µs	-	3	-	3
SMTC configuration	1		SMTC.2		SMTC.2	
	2,3		SMTC.1		SMTC.1	
EPRE ratio of PSS to SSS	1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						

N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15 kHz	-94.65		(N_{oc} for Channel 2 +8dB)	-115
	NR_FDD_FR1_B						-114.5
	NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4,5	dBm/SSB SCS	-94.65		(N_{oc} for Channel 2 +8dB)	-115
	NR_FDD_FR1_B						-114.5
	NR_TDD_FR1_C						-114
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113
	NR_FDD_FR1_F						-112.5
	NR_FDD_FR1_G						-112
	NR_FDD_FR1_H						-111.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-91.65		(N_{oc} for Channel 2 +8dB)	-112.00
	NR_FDD_FR1_B						-112.50
	NR_TDD_FR1_C						-112.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-111.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-111.00
	NR_FDD_FR1_F						-110.50
	NR_FDD_FR1_G						-110.00
	NR_FDD_FR1_H						-110.50
$\hat{E}_s/I_{ot}$		1~3	dB	10	10	13	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	1,2,4,5	dBm/SCS	-84.65		(RSRP for Cell 2 +25dB)	-118.00
	NR_FDD_FR1_B						-117.50
	NR_TDD_FR1_C						-117.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-116.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-116.00
	NR_FDD_FR1_F						-115.50
	NR_FDD_FR1_G						-115.00
	NR_FDD_FR1_H						-114.50
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5,	3		-81.65		(RSRP for Cell 2 +25dB)	-115.00
	NR_FDD_FR1_B						-114.50
	NR_TDD_FR1_C						-114.00
	NR_FDD_FR1_D, NR_TDD_FR1_D						-113.50
	NR_FDD_FR1_E, NR_TDD_FR1_E						-113.00
	NR_FDD_FR1_F						-112.50
	NR_FDD_FR1_G						-112.00
	NR_FDD_FR1_H						-111.50

Io[Note3]	NR_FDD_FR1_A, NR_TDD_FR1_A [NOTE 5],	1,2,4,5	dBm/ 9.36MHz	-56.28		Io for Channel 2 +19.75dB)T	-85.28
	NR_FDD_FR1_B						-84.78
	NR_TDD_FR1_C						-84.28
	NR_FDD_FR1_D, NR_TDD_FR1_D						-83.78
	NR_FDD_FR1_E, NR_TDD_FR1_E						-83.28
	NR_FDD_FR1_F						-82.78
	NR_FDD_FR1_G						-82.28
	NR_FDD_FR1_H						-81.78
	NR_FDD_FR1_A, NR_TDD_FR1_A [NOTE 5],	3	dBm/ 38.16MHz	-50.19		Io for Channel 2 +19.75dB)T	-79.19
	NR_FDD_FR1_B						-78.69
	NR_TDD_FR1_C						-78.19
	NR_FDD_FR1_D, NR_TDD_FR1_D						-77.69
	NR_FDD_FR1_E, NR_TDD_FR1_E						-77.19
	NR_FDD_FR1_F						-76.69
	NR_FDD_FR1_G						-76.19
	NR_FDD_FR1_H						-75.69
$\hat{E}_s/N_{oc}$		1~3	dB	10	10	13	-3
Propagation condition		1~3	-	AWGN		AWGN	
Antenna configuration		1~3		1x2		1x2	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirement in clause 10.1.4.1.1 and relative requirement in clause 10.1.4.1.2.

A.6.7.1.3 Void

A.6.7.2 SS-RSRQ

A.6.7.2.1 SA: Intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.7.1.1.

A.6.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in Table A.6.7.2.1.2-1. The absolute accuracy of SS-RSRQ intra-frequency measurement is tested by using the parameters in Table A.6.7.2.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.6.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	**Cell 2**	**Cell 1**	**Cell 2**	**Cell 1**	**Cell 2**
SSB ARFCN			freq1		freq1		freq1	
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52					
	Config 2		10: $N_{RB,c}$ = 52					
	Config 3		40: $N_{RB,c}$ = 106					
Gap Pattern ID			0					
BWP configuration	Initial DL BWP		DLBWP.0.1					
	Dedicated DL BWP		DLBWP.1.1					
	Initial UL BWP		ULBWP.0.1					
	Dedicated UL BWP		ULBWP.1.1					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Control Channel RMC	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
TRS Configuration	Config 1		TRS.1.1 FDD	-	TRS.1.1 FDD	-	TRS.1.1 FDD	-
	Config 2		TRS.1.1 TDD		TRS.1.1 TDD		TRS.1.1 TDD	
	Config 3		TRS.1.2 TDD		TRS.1.2 TDD		TRS.1.2 TDD	
OCNG Patterns			OP. 1					
SS-RSSI-Measurement			Not Applicable					
Time offset with Cell 1	Config 1	ms	-	3	-	3	-	3
	Config 2,3	µs	-	3	-	3	-	3
SMTC configuration	Config 1		SMTC.2					
	Config 2,3		SMTC.1					
SSB configuration	Config 1,2		SSB.1 FR1					
	Config 3		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								

EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15kHz	-85		-101		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-91		-		-114	
		NR_FDD_FR1_B						-113.5	
		NR_TDD_FR1_C						-113	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-112.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-112	
		NR_FDD_FR1_F						-111.5	
		NR_FDD_FR1_G						-111	
		NR_FDD_FR1_H						-110.5	
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-85		-101		-114 -113.5 -113 -112.5 -112 -111.5 -111 -110.5	
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D, NR_TDD_FR1_D							
		NR_FDD_FR1_E, NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-88		-		-111	
		NR_FDD_FR1_B						-110.5	
		NR_TDD_FR1_C						-110	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-109.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-109	
		NR_FDD_FR1_F						-108.5	
		NR_FDD_FR1_G						-108	
		NR_FDD_FR1_H						-107.5	
$\hat{E}_s/I_{ot}$			dB	-1.76		-4.7		-5..46	-5.46
$\hat{E}_s/N_{oc}$			dB	3	3	-2.9	-2.9	-4	-4
SS-RSRP Note 3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-82	-82	-103.9	-103.9	-118	-118
		NR_FDD_FR1_B						-117.5	-117.5
		NR_TDD_FR1_C						-117	-117
		NR_FDD_FR1_D, NR_TDD_FR1_D						-116.5	-116.5

		NR_FDD_FR1_E, NR_TDD_FR1_E						-116	-116
		NR_FDD_FR1_F						-115.5	-115.5
		NR_FDD_FR1_G						-115	-115
		NR_FDD_FR1_H						-114.5	-114.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85	-85	-	-	-115	-115
		NR_FDD_FR1_B						-114.5	-114.5
		NR_TDD_FR1_C						-114	-114
		NR_FDD_FR1_D, NR_TDD_FR1_D						-113.5	-113.5
		NR_FDD_FR1_E, NR_TDD_FR1_E						-113	-113
		NR_FDD_FR1_F						-112.5	-112.5
		NR_FDD_FR1_G						-112	-112
		NR_FDD_FR1_H						-111.5	-111.5
SS-RSRQ Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-16.76	-16.76	-17.34	-17.34
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D, NR_TDD_FR1_D							
		NR_FDD_FR1_E, NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
Io Note3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36MHz	-50		-70		-83.5	
		NR_FDD_FR1_B						-83	
		NR_TDD_FR1_C						-82.5	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-82	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-81.5	
		NR_FDD_FR1_F						-81	
		NR_FDD_FR1_G						-80.5	
		NR_FDD_FR1_H						-80	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16MHz	-50		-		-77.4	
		NR_FDD_FR1_B						-76.9	
		NR_TDD_FR1_C						-76.4	
		NR_FDD_FR1_D, NR_TDD_FR1_D						-75.9	
		NR_FDD_FR1_E, NR_TDD_FR1_E						-75.4	
		NR_FDD_FR1_F						-74.9	
		NR_FDD_FR1_G						-74.4	
		NR_FDD_FR1_H						-73.9	
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5:	NR operating band groups are as defined in clause 3.5.2.
Note 6:	The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.7.1.1.

A.6.7.2.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.9.1.1 and 10.1.9.1.2.

A.6.7.2.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.6.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in Table A.6.7.2.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.6.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.2.2.2-2: SS-RSRQ Inter frequency test parameters

Parameter		Unit	Test 1		Test 2		Test 3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1		FDD					
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable					
	Config 2		TDDConf.1.1					
	Config 3		TDDConf.2.1					
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52					
	Config 2		10: $N_{RB,c}$ = 52					
	Config 3		40: $N_{RB,c}$ = 106					
Gap pattern ID	Config 1,2,3		0					
BWP BW	Config 1		10: $N_{RB,c}$ = 52					
	Config 2		10: $N_{RB,c}$ = 52					
	Config 3		40: NRB,c = 106					
DRX Cycle		ms	Not Applicable					
PDSCH Reference measurement channel	Config 1,4		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2,5		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3,6		SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	R.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1 .1 FDD	-	CCR.1. 1 FDD	-	CCR.1. 1 FDD	-
	Config 2		CCR.1 .1 TDD		CCR.1. 1 TDD		CCR.1. 1 TDD	
	Config 3		CCR2. 1 TDD		CCR2.1 TDD		CCR2. 1 TDD	
TRS Configuration	Config 1		TRS.1. 1 FDD	-	TRS.1.1 FDD	-	TRS.1. 1 FDD	-
	Config 2		TRS.1. 1 TDD		TRS.1.1 TDD		TRS.1. 1 TDD	
	Config 3		TRS.1. 2 TDD		TRS.1.2 TDD		TRS.1. 2 TDD	
OCNG Patterns			OCNG pattern 1					
Time offset with Cell 1	Config 1	ms	-	3	-	3	-	3
	Config 2,3	µs	-	3	-	3	-	3
SMTC configuration	Config 1		SMTC pattern 2					
	Config 2,3		SMTC pattern 1					
SSB configuration	Config 1,2		SSB pattern 1 in FR1					
	Config 3		SSB pattern 2 in FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz					
	Config 3		30 kHz					
EPRE ratio of PSS to SSS		dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS(Note 1)								
EPRE ratio of OCNG to OCNG DMRS (Note 1)								

N_{oc} Note2	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-80.18		-106		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
N_{oc} Note2	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-86.27		-113		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-80.18		-106		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-83.27		-110		-113	
		NR_FDD_FR1_B						-112.5	
		NR_TDD_FR1_C						-112	
		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	
		NR_FDD_FR1_F						-110.5	
		NR_FDD_FR1_G						-110	
		NR_FDD_FR1_H						-109.5	
$\hat{E}_s/I_{ot}$			dB	-1.75		-1.75		3	-1.75
$\hat{E}_s/N_{oc}$			dB	-1.75		-1.75		3	-1.75
SS-RSRP Note3	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-81.93	-81.93	-107.75	-107.75	-113	-117.75
		NR_FDD_FR1_B						-112.5	-117.25
		NR_TDD_FR1_C						-112	-116.75

		NR_FDD_FR1_D NR_TDD_FR1_D						-111.5	-116.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-111	-115.75
		NR_FDD_FR1_F						-110.5	-115.2
		NR_FDD_FR1_G						-110	-114.75
		NR_FDD_FR1_H						-109.5	-114.25
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85.02	-85.02	-111.75	-111.75	-110	-114.75
		NR_FDD_FR1_B						-109.5	-114.25
		NR_TDD_FR1_C						-109	-113.75
		NR_FDD_FR1_D NR_TDD_FR1_D						-108.5	-113.25
		NR_FDD_FR1_E NR_TDD_FR1_E						-108	-112.75
		NR_FDD_FR1_F						-107.5	-112.2
		NR_FDD_FR1_G						-107	-111.75
		NR_FDD_FR1_H						-106.5	-111.25
SS-RSRQ Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-14.77	-14.77	-40.59	-40.59	12.56T	14.76T
		NR_FDD_FR1_B							
		NR_TDD_FR1_C							
		NR_FDD_FR1_D NR_TDD_FR1_D							
		NR_FDD_FR1_E NR_TDD_FR1_E							
		NR_FDD_FR1_F							
		NR_FDD_FR1_G							
		NR_FDD_FR1_H							
Io Note3	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-50		-75.83		-83.28	-85.83
		NR_FDD_FR1_B						-82.78	-85.33
		NR_TDD_FR1_C						-82.28	-84.83
		NR_FDD_FR1_D NR_TDD_FR1_D						-81.78	-84.33
		NR_FDD_FR1_E NR_TDD_FR1_E						-81.28	-83.83

		NR_FDD_FR1_F						-80.78	-83.33
		NR_FDD_FR1_G						-80.28	-82.83
		NR_FDD_FR1_H						-79.78	-82.33
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-50		-76.73		-77.19	-79.73
		NR_FDD_FR1_B						-76.69	-79.23
		NR_TDD_FR1_C						-76.19	-78.73
		NR_FDD_FR1_D NR_TDD_FR1_D						-75.69	-78.23
		NR_FDD_FR1_E NR_TDD_FR1_E						-75.19	-77.73
		NR_FDD_FR1_F						-74.69	-77.23
		NR_FDD_FR1_G						-74.19	-76.73
		NR_FDD_FR1_H						-73.69	-76.53
Propagation condition			-	AWGN	AWGN	AWGN	AWGN	AWGN	AWGN
Antenna configuration				1x2	1x2	1x2	1x2	1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in clause 3.5.2.
Note 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy shall fulfil the requirements in clause 10.1.9.1.1 and 10.1.9.1.2.

A.6.7.3 SS-SINR

A.6.7.3.1 SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.12.1.1.

A.6.7.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configuration are shown in Table A.6.7.3.1.2-1. The absolute accuracy of SS-SINR intra-frequency measurement is tested by using the parameters in Table A.6.7.3.1.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is the target cell.

Table A.6.7.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			freq1		freq1	
Duplex mode	Config 1		FDD			
	Config 2,3		TDD			
TDD configuration	Config 1		Not Applicable			
	Config 2		TDDConf.1.1			
	Config 3		TDDConf.2.1			
Downlink initial BWP configuration			DLBWP.0.1			
Downlink dedicated BWP configuration			DLBWP.1.1			
Uplink initial BWP configuration			ULBWP.0.1			
Uplink dedicated BWP configuration			ULBWP.1.1			
DRX Cycle configuration		ms	Not Applicable			
TRS configuration	Config 1		TRS.1.1 FDD			
	Config 2		TRS.1.1 TDD			
	Config 3		TRS.1.2 TDD			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR.2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	
	Config 2		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Reference Channel	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP.1			
SS-RSSI-Measurement			Not Applicable			
SMTC configruation			SMTC.1			
SSB configuration	Config 1,2		SSB.1 FR1			
	Config 3		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15			
	Config 3		30			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/15kHz	-93		-116	
	NR_FDD_FR1_B				-115.5	
	NR_TDD_FR1_C				-115	
	NR_FDD_FR1_D, NR_TDD_FR1_D				-114.5	

		NR_FDD_FR1_E, NR_TDD_FR1_E				-114	
		NR_FDD_FR1_F				-113.5	
		NR_FDD_FR1_G				-113	
		NR_FDD_FR1_H				-112.5	
N_{oc} Note2	Config 1,2		dBm/SCS	-93		Same as Noc for 15 kHz	
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-90		-113	
		NR_FDD_FR1_B				-112.5	
		NR_TDD_FR1_C				-112	
		NR_FDD_FR1_D, NR_TDD_FR1_D				-111.5	
		NR_FDD_FR1_E, NR_TDD_FR1_E				-111	
		NR_FDD_FR1_F				-110.5	
		NR_FDD_FR1_G				-110	
		NR_FDD_FR1_H				-109.5	
$\hat{E}_s/I_{ot}$			dB	0	-3.19	-5.46	-5.46
$\hat{E}_s/N_{oc}$			dB	4.54	2.66	-4	-4
SS-RSRP Note3	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/SCS	-88.46	-90.34	-120	-120
		NR_FDD_FR1_B				-119.5	-119.5
		NR_TDD_FR1_C				-119	-119
		NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5	-118.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-118	-118
		NR_FDD_FR1_F				-117.5	-117.5
		NR_FDD_FR1_G				-117	-117
		NR_FDD_FR1_H				-116.5	-116.5
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6		-85.46	-87.34	-117	-117
		NR_FDD_FR1_B				-116.5	-116.5
		NR_TDD_FR1_C				-116	-116
		NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5	-115.5
		NR_FDD_FR1_E, NR_TDD_FR1_E				-115	-115
		NR_FDD_FR1_F				-114.5	-114.5
		NR_FDD_FR1_G				-114	-114
		NR_FDD_FR1_H				-113.5	-113.5
SS-SINR Note3		NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dB	0	-3.19	-5.46	-5.46
		NR_FDD_FR1_B					
		NR_TDD_FR1_C					
		NR_FDD_FR1_D, NR_TDD_FR1_D					
		NR_FDD_FR1_E, NR_TDD_FR1_E					
		NR_FDD_FR1_F					
		NR_FDD_FR1_G					
		NR_FDD_FR1_H					

Io[Note3]	Config 1,2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 9.36MHz	-57.5	-85.51
		NR_FDD_FR1_B			-85.01
		NR_TDD_FR1_C			-84.51
		NR_FDD_FR1_D, NR_TDD_FR1_D			-84.01
		NR_FDD_FR1_E, NR_TDD_FR1_E			-83.51
		NR_FDD_FR1_F			-83.01
		NR_FDD_FR1_G			-82.51
		NR_FDD_FR1_H			-82.01
	Config 3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 6	dBm/ 38.16MHz	-51.41	-79.41
		NR_FDD_FR1_B			-78.91
		NR_TDD_FR1_C			-78.41
		NR_FDD_FR1_D, NR_TDD_FR1_D			-77.91
		NR_FDD_FR1_E, NR_TDD_FR1_E			-77.41
		NR_FDD_FR1_F			-76.91
		NR_FDD_FR1_G			-76.41
		NR_FDD_FR1_H			-75.91
Propagation condition			-	AWGN	
Antenna configuration			-	1x2	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in clause 3.5.2.
Note 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.3.1.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.12.1.1.

A.6.7.3.2 SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell

A.6.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.14.1.1 and 10.1.14.1.2.

A.6.7.3.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.6.7.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in Table A.6.7.3.2.2-2. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A.6.7.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.3.2.2-2: SS-SINR Inter frequency test parameters

Parameter			Unit	Test 1		Test 2		Test 3	
				Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN				freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode	Config 1			FDD					
	Config 2,3			TDD					
TDD configuration	Config 1			Not Applicable					
	Config 2			TDDConf.1.1					
	Config 3			TDDConf.2.1					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
DRX Cycle configuration			ms	Not Applicable					
TRS configuration	Config 1			TRS.1.1 FDD					
	Config 2			TRS.1.1 TDD					
	Config 3			TRS.1.2 TDD					
PDSCH Reference measurement channel	Config 1			SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2			SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3			SR2.1 TDD		SR2.1 TDD		SR2.1 TDD	
RMSI CORESET Reference Channel	Config 1			CR.1.1 FDD	-	R.1.1 FDD	-	CR.1.1 FDD	
	Config 2			CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3			CR2.1 TDD		CR2.1 TDD		CR2.1 TDD	
Dedicated CORESET Reference Channel	Config 1			CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2			CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3			CCR2.1 TDD		CCR2.1 TDD		CCR2.1 TDD	
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
Time offset with Cell 1	Config 1		ms	-	3	-	3	-	3
	Config 2,3		µs	-	3	-	3	-	3
SMTC configuration	Config 1			SMTC pattern 2					
	Config 2,3			SMTC pattern 1					
SSB configuration	Config 1,2			SSB.1 FR1					
	Config 3			SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2		kHz	15					
	Config 3			30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-88		-108.5		-119.5	
		NR_FDD_FR1_B						-119	
		NR_TDD_FR1_C						-118.5	

		NR_FDD_FR1_D NR_TDD_FR1_D						-118	
		NR_FDD_FR1_E NR_TDD_FR1_E						-117.5	
		NR_FDD_FR1_F						-117	
		NR_FDD_FR1_G						-116.5	
		NR_FDD_FR1_H						-116	
N_{oc} Note2	Config 1,2 N		dBm/15kHz	-88		-108.5		Same as Noc for 15kHz T	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85		-105.5		-116.5	
		NR_FDD_FR1_B						-116	
		NR_TDD_FR1_C						-115.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-115	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114.5	
		NR_FDD_FR1_F						-114	
		NR_FDD_FR1_G						-114.5	
		NR_FDD_FR1_H						-113	
$\hat{E}_s/I_{ot}$			dB	-1.75	-1.75	20	20	-4.0	-4.0
$\hat{E}_s/N_{oc}$			dB	-1.75		20		-4.0	
SS-RSRP Note3	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75		-88.5		-123.5	
		NR_FDD_FR1_B						-123	
		NR_TDD_FR1_C						-122.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-122	
		NR_FDD_FR1_E NR_TDD_FR1_E						-121.5	
		NR_FDD_FR1_F						-121	
		NR_FDD_FR1_G						-120.5	
		NR_FDD_FR1_H						-120	
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75		-85.5		-120.5	
		NR_FDD_FR1_B						-120	
		NR_TDD_FR1_C						-119.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-119	
		NR_FDD_FR1_E NR_TDD_FR1_E						-118.5	
		NR_FDD_FR1_F						-118	
		NR_FDD_FR1_G						-117.5	
		NR_FDD_FR1_H						-117	
SS-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75		20		-4.0	
		NR_FDD_FR1_B							

		NR_TDD_FR1_C				
		NR_FDD_FR1_D NR_TDD_FR1_D				
		NR_FDD_FR1_E NR_TDD_FR1_E				
		NR_FDD_FR1_F				
		NR_FDD_FR1_G				
		NR_FDD_FR1_H				
Io[Note3]	Config 1,2	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36MHz	-57.83	-60.5	-90.09
		NR_FDD_FR1_B				-89.59
		NR_TDD_FR1_C				-89.09
		NR_FDD_FR1_D NR_TDD_FR1_D				-88.59
		NR_FDD_FR1_E NR_TDD_FR1_E				-88.09
		NR_FDD_FR1_F				-87.59
		NR_FDD_FR1_G				-87.09
		NR_FDD_FR1_H				-86.59
	Config 3	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16MHz	-51.73	-54.41	-84
		NR_FDD_FR1_B				-83.5
		NR_TDD_FR1_C				-83
		NR_FDD_FR1_D NR_TDD_FR1_D				-82.5
		NR_FDD_FR1_E NR_TDD_FR1_E				-82
		NR_FDD_FR1_F				-81.5
		NR_FDD_FR1_G				-81
		NR_FDD_FR1_H				-80.5
Propagation condition			-	AWGN		
Antenna configuration			-	1x2		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in clause 3.5.2.
Note 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.6.7.3.2.3 Test Requirements

The SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.14.1.1 and 10.1.14.1.2.

A.6.7.4 L1-RSRP measurement for beam reporting

A.6.7.4.1 SSB based L1-RSRP measurement

A.6.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5.2 and clause 10.1.19.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in Table A.6.7.4.1.1-1.

Table A.6.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.4.1.2 Test parameters

In this set of test cases there one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.7.4.1.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.6.7.4.1.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.6.7.4.1.2-1: FR1 SSB based L1-RSRP test parameters

Parameter		Config	Unit	Test 1	Test 2
SSB GSCN		1~3		freq1	freq1
Duplex mode		1		FDD	FDD
		2		TDD	TDD
		3		TDD	TDD
TDD Configuration		1		N/A	N/A
		2		TDDConf.1.1	TDDConf.1.1
		3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$		1	MHz	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
		2		10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
		3		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel		1		SR.1.1 FDD	SR.1.1 FDD
		2		SR.1.1 TDD	SR.1.1 TDD
		3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel		1		CR.1.1 FDD	CR.1.1 FDD
		2		CR.1.1 TDD	CR.1.1 TDD
		3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel		1		CCR.1.1 FDD	CCR.1.1 FDD
		2		CCR.1.1 TDD	CCR.1.1 TDD
		3		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration		1		SSB.3 FR1	SSB.3 FR1
		2		SSB.3 FR1	SSB.3 FR1
		3		SSB.4 FR1	SSB.4 FR1
OCNG Patterns		1~3		OP.1	OP.1
Initial BWP Configuration		1~3		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
TRS configuration		1		TRS.1.1 FDD	TRS.1.1 FDD
		2		TRS.1.1 TDD	TRS.1.1 TDD
		3		TRS.1.2 TDD	TRS.1.2 TDD
Dedicated BWP configuration		1~3		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1~3		SMTC.1	SMTC.1
reportConfigType		1~3		periodic	periodic
reportQuantity		1~3		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS		1~3		2	2
L1-RSRP reporting period		1~3		slot80	slot80
EPRE ratio of PSS to SSS		1~3	dB	0	0
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15kHz	-94.65	-117

	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/SSB SCS	-94.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65	-114
	NR_FDD_FR1_B				-113.5
	NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
$\hat{E}_s/I_{ot}$		1~3	dB	10	-3
SSB RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/SSB SCS	-84.65	-120
	NR_FDD_FR1_B				-119.5
	NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5

Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B				-86.78
	NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B				-80.69
	NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
$\hat{E}_s/N_{oc}$		1~3	dB	10	-3
Propagation condition		1~3		AWGN	AWGN
Antenna configuration		1~3		1x2	1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.					

A.6.7.4.1.3 Test Requirements

The L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in clauses 10.1.19.1.

A.6.7.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.6.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.5.3 and clause 10.1.19.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in Table A.6.7.4.2.1-1.

Table A.6.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, FDD duplex mode
2	NR 15 kHz CSI-RS SCS, 10 MHz bandwidth, TDD duplex mode
3	NR 30kHz CSI-RS SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.4.2.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.7.4.2.2-1 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.6.7.4.2.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.6.7.4.2.2-1: FR1 CSI-RS based L1-RSRP test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1~3		freq1	freq1
Duplex mode	1		FDD	FDD
	2		TDD	TDD
	3		TDD	TDD
TDD Configuration	1		N/A	N/A
	2		TDDConf.1.1	TDDConf.1.1
	3		TDDConf.2.1	TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
	2		10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
	3		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 FDD	SR.1.1 FDD
	2		SR.1.1 TDD	SR.1.1 TDD
	3		SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 FDD	CR.1.1 FDD
	2		CR.1.1 TDD	CR.1.1 TDD
	3		CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	CCR.1.1 FDD
	2		CCR.1.1 TDD	CCR.1.1 TDD
	3		CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration	1		SSB.1 FR1	SSB.1 FR1
	2		SSB.1 FR1	SSB.1 FR1
	3		SSB.2 FR1	SSB.2 FR1
OCNG Patterns	1~3		OP.1	OP.1
TRS configuration	1		TRS.1.1 FDD	TRS.1.1 FDD
	2		TRS.1.1 TDD	TRS.1.1 TDD
	3		TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~3		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~3		SMTC.1	SMTC.1
CSI-RS	1		CSI-RS 1.2 FDD	CSI-RS 1.2 FDD
	2		CSI-RS 1.2 TDD	CSI-RS 1.2 TDD
	3		CSI-RS 2.2 TDD	CSI-RS 2.2 FDD
reportConfigType	1~3		periodic	periodic
reportQuantity	1~3		cri-RSRP	cri-RSRP
Number of reported RS	1~3		2	2
L1-RSRP reporting period	1~3		slot80	slot80
EPRE ratio of PSS to SSS	1~3	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				

N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~3	dBm/15kHz	-94.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/CSI-RS SCS	-94.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114
	NR_FDD_FR1_H				-113.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-91.65	-114
	NR_FDD_FR1_B				-113.5
	NR_TDD_FR1_C				-114
	NR_FDD_FR1_D, NR_TDD_FR1_D				-112.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-112
	NR_FDD_FR1_F				-111.5
	NR_FDD_FR1_G				-111
	NR_FDD_FR1_H				-110.5
$\hat{E}_s/I_{ot}$		1~3	dB	10	-3
CSI-RS RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/CSI-RS SCS	-84.65	-120
	NR_FDD_FR1_B				-119.5
	NR_TDD_FR1_C				-119
	NR_FDD_FR1_D, NR_TDD_FR1_D				-118.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-118
	NR_FDD_FR1_F				-117.5
	NR_FDD_FR1_G				-117
	NR_FDD_FR1_H				-116.5
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3		-81.65	-117
	NR_FDD_FR1_B				-116.5
	NR_TDD_FR1_C				-116
	NR_FDD_FR1_D, NR_TDD_FR1_D				-115.5
	NR_FDD_FR1_E, NR_TDD_FR1_E				-115
	NR_FDD_FR1_F				-114.5
	NR_FDD_FR1_G				-114

	NR_FDD_FR1_H				-113.5
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2	dBm/9.36 MHz	-56.28	-87.28
	NR_FDD_FR1_B				-86.78
	NR_TDD_FR1_C				-86.28
	NR_FDD_FR1_D, NR_TDD_FR1_D				-85.78
	NR_FDD_FR1_E, NR_TDD_FR1_E				-85.28
	NR_FDD_FR1_F				-84.78
	NR_FDD_FR1_G				-84.28
	NR_FDD_FR1_H				-83.78
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3	dBm/38.16 MHz	-50.19	-81.19
	NR_FDD_FR1_B				-80.69
	NR_TDD_FR1_C				-80.19
	NR_FDD_FR1_D, NR_TDD_FR1_D				-79.69
	NR_FDD_FR1_E, NR_TDD_FR1_E				-79.19
	NR_FDD_FR1_F				-78.69
	NR_FDD_FR1_G				-78.19
	NR_FDD_FR1_H				-77.69
$\hat{E}_s/N_{oc}$		1~3	dB	10	-3
Propagation condition		1~3		AWGN	AWGN
Antenna configuration		1~3		1x2	1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.					

A.6.7.4.2.3 Test Requirements

The L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in clause 10.1.19.2.

A.6.7.5 E-UTRAN RSRP

A.6.7.5.1 SA: inter-RAT measurement accuracy with FR1 serving cell

A.6.7.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2.2 for SA inter-RAT E-UTRAN RSRP measurements.

A.6.7.5.1.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.6.7.5.1.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RSRP are tested by using the parameters in A.6.7.5.1.2-2 and A.6.7.5.1.2-3.

Table A.6.7.5.1.2-1: Inter-RAT E-UTRAN RSRP supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.5.1.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RSRP test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.1.2
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52 (FDD)
	Config 2, 5		10: $N_{RB,c}$ = 52 (TDD)
	Config 3, 6		40: $N_{RB,c}$ = 106 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD
	Config 3, 6		SR.2.1 TDD
CORSET reference channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern[Note1]			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc}[Note2]		dBm/15 kHz	-104
N_{oc}[Note2]	Config 1, 2, 4, 5	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	17
$\hat{E}_s/I_{ot}$[Note3]		dB	17
SS-RSRP[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
Io[Note3]	Config 1, 2, 4, 5	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/38.16 MHz	-52.87
Propagation condition			AWGN
Antenna Configuration and Correlation Matrix			1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: $\hat{E}_s/I_{ot}$, SS-RSRP, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.7.5.1.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RSRP test parameters

Parameter		Unit	Cell 2	
			Test 1	**Test 2**
E-UTRA RF channel number			1	
Duplex mode	Config 1, 2, 3		FDD	
	Config 4, 5, 6		TDD	
TDD special subframe configuration[Note1]	Config 1, 2, 3		N/A	
	Config 4, 5, 6		6	
TDD uplink-downlink configuration[Note1]	Config 1, 2, 3		N/A	
	Config 4, 5, 6		1	
$BW_{channel}$		MHz	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]			-	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]	Config 1, 2, 3		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
	Config 4, 5, 6		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]	Config 1, 2, 3		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD	
	Config 4, 5, 6		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD	
PBCH_RA		dB	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	Bands FDD_A [Note 9], TDD_A	dBm/15kHz	-91.65	-117
	Bands FDD_B1, FDD_B2 [Note 10]			-116.5
	Bands FDD_C, TDD_C			-116
	Bands FDD_D			-115.5
	Bands FDD_E, FDD_F [Note 7], TDD_E			-115
	Bands FDD_G [Note 8]			-114
	Bands FDD_H			-113.5
$\hat{E}_s/N_{oc}$		dB	10	-4
$\hat{E}_s/I_{ot}$[Note5]		dB	10	-4
RSRP[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/15kHz	-81.65	-121
	Bands FDD_B1, FDD_B2 [Note 10]			-120.5
	Bands FDD_C, TDD_C			-120

	Bands FDD_D			-119.5
	Bands FDD_E, FDD_F Note 7, TDD_E			-119
	Bands FDD_G Note 8			-118
	Bands FDD_H			-117.5
SCH_RP Note5	Bands FDD_A Note 9, TDD_A	dBm/15kHz	-81.65	-121
	Bands FDD_B1, FDD_B2 Note 10			-120.5
	Bands FDD_C, TDD_C			-120
	Bands FDD_D			-119.5
	Bands FDD_E, FDD_F Note 7, TDD_E			-119
	Bands FDD_G Note 8			-118
	Bands FDD_H			-117.5
Io Note5	Bands FDD_A Note 9, TDD_A	dBm/Ch BW	-53.45 + 10log($N_{RB,c}$/50)	-87.76 + 10log($N_{RB,c}$/50)
	Bands FDD_B1, FDD_B2 Note 10			-87.26 + 10log($N_{RB,c}$/50)
	Bands FDD_C, TDD_C			-86.76 + 10log($N_{RB,c}$/50)
	Bands FDD_D			-86.26 + 10log($N_{RB,c}$/50)
	Bands FDD_E, FDD_F Note 7, TDD_E			-85.76 + 10log($N_{RB,c}$/50)
	Bands FDD_G Note 8			-84.76 + 10log($N_{RB,c}$/50)
	Bands FDD_H			-84.26 + 10log($N_{RB,c}$/50)
Propagation Condition			AWGN	
Antenna Configuration and Correlation Matrix			1x2	

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].
Note 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.
Note 8: Except Band 29.
Note 9: Except Band 32, Band 75 and Band 76.
Note 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.

A.6.7.5.1.3 Test Requirements

The SA inter-RAT E-UTRAN RSRP measurement accuracy for cell 2 shall fulfil absolute requirement in clause 10.2.2.

A.6.7.6 E-UTRAN RSRQ

A.6.7.6.1 SA: inter-RAT measurement accuracy with FR1 serving cell

A.6.7.6.1.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2.3 for SA inter-RAT E-UTRAN RSRQ measurements.

A.6.7.6.1.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.6.7.6.1.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RSRQ are tested by using the parameters in A.6.7.6.1.2-2 and A.6.7.6.1.2-3.

Table A.6.7.6.1.2-1: Inter-RAT E-UTRAN RSRQ supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.6.1.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RSRQ test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.1.2
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52 (FDD)
	Config 2, 5		10: $N_{RB,c}$ = 52 (TDD)
	Config 3, 6		40: $N_{RB,c}$ = 106 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD
	Config 3, 6		SR.2.1 TDD
CORSET reference channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern^{Note1}			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc}^{Note2}		dBm/15 kHz	-104
N_{oc}^{Note2}	Config 1, 2, 4, 5	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	dB
$\hat{E}_s/I_{ot}$^{Note3}		dB	dB
SS-RSRQ^{Note3}	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP^{Note3}	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
Io^{Note3}	Config 1, 2, 4, 5	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/38.16 MHz	-52.87
Propagation condition			AWGN
Antenna Configuration and Correlation Matrix			1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: $\hat{E}_s/I_{ot}$, SS-RSRQ, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.7.6.1.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RSRQ test parameters

Parameter	Unit	Cell 2		
		Test 1	Test 2	Test 3

E-UTRA RF channel number			1		
Duplex mode	Config 1, 2, 3		FDD		
	Config 4, 5, 6		TDD		
TDD special subframe configuration[Note1]	Config 1, 2, 3		N/A		
	Config 4, 5, 6		6		
TDD uplink-downlink configuration[Note1]	Config 1, 2, 3		N/A		
	Config 4, 5, 6		1		
$BW_{channel}$		MHz	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100		
PDSCH parameters: DL Reference Measurement Channel[Note2]			-		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]	Config 1, 2, 3		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
	Config 4, 5, 6		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note2]	Config 1, 2, 3		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD		
	Config 4, 5, 6		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD		
PBCH_RA		dB	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note3]					
OCNG_RB[Note3]					
N_{oc}[Note4]	Bands FDD_A [Note 9], TDD_A	dBm/15kHz	-83	-104.70	-119.5
	Bands FDD_B1, FDD_B2 [Note 10]				-119
	Bands FDD_C, TDD_C				-118.5
	Bands FDD_D				-118
	Bands FDD_E, FDD_F [Note 7], TDD_E				-117.5
	Bands FDD_G [Note 8]				-116.5
	Bands FDD_H				-116
$\hat{E}_s/N_{oc}$		dB	-1.75	-4.0	-4.0
$\hat{E}_s/I_{ot}$[Note5]		dB	-1.75	-4.0	-4.0
RSRP[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/15kHz	-84.75	-108.70	-123.5
	Bands FDD_B1, FDD_B2 [Note 10]				-123
	Bands FDD_C, TDD_C				-122.5
	Bands FDD_D				-122

	Bands FDD_E, FDD_F Note 7, TDD_E				-121.5
	Bands FDD_G Note 8				-120.5
	Bands FDD_H				-120
RSRQ Note5	Bands FDD_A Note 9, TDD_A	dB	-14.76	-16.25	-16.25
	Bands FDD_B1, FDD_B2 Note 10				
	Bands FDD_C, TDD_C				
	Bands FDD_D				
	Bands FDD_E, FDD_F Note 7, TDD_E				
	Bands FDD_G Note 8				
	Bands FDD_H				
Io Note5	Bands FDD_A Note 9, TDD_A	dBm/Ch BW	-53 + 10log($N_{RB,c}$/50)	-75.46 + 10log($N_{RB,c}$/50)	-90.26 + 10log($N_{RB,c}$/50)
	Bands FDD_B1, FDD_B2 Note 10				-89.76 + 10log($N_{RB,c}$/50)
	Bands FDD_C, TDD_C				-89.26 + 10log($N_{RB,c}$/50)
	Bands FDD_D				-88.76 + 10log($N_{RB,c}$/50)
	Bands FDD_E, FDD_F Note 7, TDD_E				-88.26 + 10log($N_{RB,c}$/50)
	Bands FDD_G Note 8				-87.26 + 10log($N_{RB,c}$/50)
	Bands FDD_H				-86.76 + 10log($N_{RB,c}$/50)
Propagation Condition			AWGN		
Antenna Configuration and Correlation Matrix			1x2		

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5: $\hat{E}_s/I_{ot}$, RSRP, RSRQ and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].
Note 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.
Note 8: Except Band 29.
Note 9: Except Band 32, Band 75 and Band 76.
Note 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.

A.6.7.6.1.3 Test Requirements

The SA inter-RAT E-UTRAN RSRQ measurement accuracy for cell 2 shall fulfil absolute requirement in clause 10.2.3.

A.6.7.7 E-UTRAN RS-SINR

A.6.7.7.1 SA: inter-RAT measurement accuracy with FR1 serving cell

A.6.7.7.1.1 Test Purpose and Environment

The purpose of this test is to verify that the E-UTRAN RS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.2.4 for SA inter-RAT E-UTRAN RS-SINR measurements.

A.6.7.7.1.2 Test parameters

In each test there are two cells: Cell 1 and Cell 2. Cell 1 is the NR PCell and Cell 2 is an E-UTRAN inter-RAT neighbour cell. Supported test configurations are shown in table A.6.7.7.1.2-1. The measurement accuracy of SA inter-RAT E-UTRAN RS-SINR are tested by using the parameters in A.6.7.7.1.2-2 and A.6.7.7.1.2-3.

Table A.6.7.7.1.2-1: Inter-RAT E-UTRAN RS-SINR supported test configurations with FR1 serving cell

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, E-UTRAN TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
6	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, E-UTRAN TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.6.7.7.1.2-2: NR Cell specific test parameters for SA Inter-RAT E-UTRAN RS-SINR test parameters

Parameter		Unit	Cell 1
NR RF channel number			1
Duplex mode	Config 1, 4		FDD
	Config 2, 3, 5, 6		TDD
TDD Configuration	Config 1, 4		N/A
	Config 2, 5		TDDConf.1.1
	Config 3, 6		TDDConf.1.2
$BW_{channel}$	Config 1, 4	MHz	10: $N_{RB,c}$ = 52 (FDD)
	Config 2, 5		10: $N_{RB,c}$ = 52 (TDD)
	Config 3, 6		40: $N_{RB,c}$ = 106 (TDD)
Gap pattern Id			0
PDSCH reference measurement channel	Config 1, 4		SR.1.1 FDD
	Config 2, 5		SR.1.1 TDD
	Config 3, 6		SR.2.1 TDD
CORSET reference channel	Config 1, 4		CR.1.1 FDD
	Config 2, 5		CR.1.1 TDD
	Config 3, 6		CR.2.1 TDD
BWP configurations	Initial DL BWP		DLBWP.0.1
	Dedicated DL BWP		DLBWP.1.1
	Initial UL BWP		ULBWP.0.1
	Dedicated UL BWP		ULBWP.1.1
OCNG pattern[Note1]			OP.1
SMTC configuration			SMTC.1
SSB configuration	Config 1, 2, 4, 5		SSB.1 FR1
	Config 3, 6		SSB.2 FR1
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS			
EPRE ratio of OCNG to OCNG DMRS			
N_{oc}[Note2]		dBm/15 kHz	-104
N_{oc}[Note2]	Config 1, 2, 4, 5	dBm/SCS	-104
	Config 3, 6		-101
$\hat{E}_s/N_{oc}$		dB	17
$\hat{E}_s/I_{ot}$[Note3]		dB	17
SS-RS-SINR[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
SSB_RP[Note3]	Config 1, 2, 4, 5	dBm/SCS	-87
	Config 3, 6		-84
Io[Note3]	Config 1, 2, 4, 5	dBm/9.36 MHz	-58.96
	Config 3, 6	dBm/38.16 MHz	-52.87
Propagation condition			AWGN
Antenna Configuration and Correlation Matrix			1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: $\hat{E}_s/I_{ot}$, SS-RS-SINR, SSB_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.6.7.7.1.2-3: E-UTRAN Cell specific test parameters for SA Inter-RAT E-UTRAN RS-SINR test parameters

Parameter		Unit	Cell 2		
			Test 1	Test 2	Test 3
E-UTRA RF channel number			1		
Duplex mode	Config 1, 2, 3		FDD		
	Config 4, 5, 6		TDD		
TDD special subframe configuration[Note1]	Config 1, 2, 3		N/A		
	Config 4, 5, 6		6		
TDD uplink-downlink configuration[Note1]	Config 1, 2, 3		N/A		
	Config 4, 5, 6		1		
$BW_{channel}$		MHz	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100		
PDSCH parameters: DL Reference Measurement Channel[Note2]			-		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]	Config 1, 2, 3		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
	Config 4, 5, 6		5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note2]	Config 1, 2, 3		5 MHz: OP.19 FDD 10 MHz: OP.6 FDD 20 MHz: OP.14 FDD		
	Config 4, 5, 6		5 MHz: OP.10 TDD 10 MHz: OP.2 TDD 20 MHz: OP.8 TDD		
PBCH_RA		dB	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA[Note3]					
OCNG_RB[Note3]					
N_{oc}[Note4]	Bands FDD_A [Note 9], TDD_A	dBm/15kHz	-88	-108.50	-119.5
	Bands FDD_B1, FDD_B2 [Note 10]				-119
	Bands FDD_C, TDD_C				-118.5
	Bands FDD_D				-118
	Bands FDD_E, FDD_F [Note 7], TDD_E				-117.5
	Bands FDD_G [Note 8]				-116.5
	Bands FDD_H				-116
CRS $\hat{E}_s/N_{oc1}$		dB	-1.75	20.0	-4.0
CRS $\hat{E}_s/I_{ot}$[Note5]		dB	-1.75	20.0	-4.0
RSRP[Note5]	Bands FDD_A [Note 9], TDD_A	dBm/15kHz	-89.75	-88.50	-123.5
	Bands FDD_B1, FDD_B2 [Note 10]				-123
	Bands FDD_C, TDD_C				-122.5

	Bands FDD_D				-122
	Bands FDD_E, FDD_F Note 7, TDD_E				-121.5
	Bands FDD_G Note 8				-120.5
	Bands FDD_H				-120
RS-SINR Note5	Bands FDD_A Note 9, TDD_A	dB	-1.75	20	-4.0
	Bands FDD_B1, FDD_B2 Note 10				
	Bands FDD_C, TDD_C				
	Bands FDD_D				
	Bands FDD_E, FDD_F Note 7, TDD_E				
	Bands FDD_G Note 8				
	Bands FDD_H				
Io Note5	Bands FDD_A Note 9, TDD_A	dBm/Ch BW	-53.79 + 10log($N_{RB,c}$/50)	-60.56 + 10log($N_{RB,c}$/50)	-93.48 + 10log($N_{RB,c}$/50)
	Bands FDD_B1, FDD_B2 Note 10				-92.98 + 10log($N_{RB,c}$/50)
	Bands FDD_C, TDD_C				-92.48 + 10log($N_{RB,c}$/50)
	Bands FDD_D				-91.98 + 10log($N_{RB,c}$/50)
	Bands FDD_E, FDD_F Note 7, TDD_E				-91.48 + 10log($N_{RB,c}$/50)
	Bands FDD_G Note 8				-90.48 + 10log($N_{RB,c}$/50)
	Bands FDD_H				-89.98 + 10log($N_{RB,c}$/50)
Propagation Condition			AWGN		
Antenna Configuration and Correlation Matrix			1x2		

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 4a: Void.
Note 5: CRS $\hat{E}_s/I_{ot}$, RSRP, RS-SINR and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 6: E-UTRA operating band groups are as defined in clause 3.5 of TS 36.133 [15].
Note 7: For Band 26, the tests shall be performed with the carrier frequency of assigned E-UTRA channel bandwidth within 865-894 MHz.
Note 8: Except Band 29.
Note 9: Except Band 32, Band 75 and Band 76.
Note 10: For Band 74, the tests shall be performed with the carrier frequency of the assigned E-UTRA channel bandwidth within 1475.9-1510.9 MHz.

A.6.7.7.1.3 Test Requirements

The SA inter-RAT E-UTRAN RS-SINR measurement accuracy for cell 2 shall fulfil absolute requirement in clause 10.2.4.

A.6.7.8 CLI measurements

A.6.7.8.1 SA SRS-RSRP measurement accuracy with FR1 serving cell

A.6.7.8.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.22.1.1 with the testing configurations for NR cells in Table A.6.7.8.1.1-1.

Table A.6.7.8.1.1-1: Applicable NR configurations for FR1 SRS-RSRP accuracy test

Config	Description
1	15kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	30kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.8.1.2 Test parameters

In this set of test cases there is one cell in the test, FR1 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.7.8.1.2-1 below. The test parameter for the (virtual) neighbor cell UE transmitting SRS are given in Table A.6.7.8.1.2-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in Table A.6.7.8.1.2-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 1 data symbol before SRS to be transmitted.

Table A.6.7.8.1.2-1: FR1 test parameters for SRS-RSRP accuracy for PCell

Parameter		Config	Unit	Test 1	Test 2	Test 3
SSB GSCN		1~2		freq1	freq1	freq1
Duplex mode		1~2		TDD	TDD	TDD
TDD configuration		1		TDDConf.1.1	TDDConf.1.1	TDDConf.1.1
		2		TDDConf.2.1	TDDConf.2.1	TDDConf.2.1
$BW_{channel}$		1	MHz	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52	10: $N_{RB,c}$ = 52
		2		40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106	40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel		1		SR.1.1 TDD	SR.1.1 TDD	SR.1.1 TDD
		2		SR.2.1 TDD	SR.2.1 TDD	SR.2.1 TDD
RMSI CORESET Reference Channel		1		CR.1.1 TDD	CR.1.1 TDD	CR.1.1 TDD
		2		CR.2.1 TDD	CR.2.1 TDD	CR.2.1 TDD
Dedicated CORESET Reference Channel		1		CCR.1.1 TDD	CCR.1.1 TDD	CCR.1.1 TDD
		2		CCR.2.1 TDD	CCR.2.1 TDD	CCR.2.1 TDD
SSB configuration		1		SSB.1 FR1	SSB.1 FR1	SSB.1 FR1
		2		SSB.2 FR1	SSB.2 FR1	SSB.2 FR1
OCNG Patterns		1~2		OP.1	OP.1	OP.1
TRS configuration		1		TRS.1.1 TDD	TRS.1.1 TDD	TRS.1.1 TDD
		2		TRS.1.2 TDD	TRS.1.2 TDD	TRS.1.2 TDD
Initial BWP Configuration		1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration		1~2		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
SMTC configuration		1~2		SMTC.1	SMTC.1	SMTC.1
Time offset between DL from serving cell and SRS from test system		1~2	µs	17.67	17.67	17.67
EPRE ratio of PSS to SSS		1~2	dB	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
N_{oc} Note2	NR_TDD_FR1_A NOTE 3	1	dBm/15kHz	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 5	2		Not applicable Note 4	-91	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112

N_{oc} Note2	NR_TDD_FR1_A NOTE 3	1	dBm/SRS SCS	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 3	2		Not applicable Note 4	-88	-111
	NR_TDD_FR1_C					-110
	NR_TDD_FR1_D					-109.5
	NR_TDD_FR1_E					-109
Note 1:	OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.					
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.					
Note 3:	The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification					
Note 4:	Test 1 is not used when testing with 30kHz SSB SCS					

Table A.6.7.8.1.2-2: FR1 test parameters for SRS-RSRP accuracy for neighbour cell UE

Parameter		Config	Unit	Test 1	Test 2	Test 3
N_{oc} Note2	NR_TDD_FR1_A NOTE 5	1	dBm/15kHz	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 5	2		Not applicable Note 6	-91	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
N_{oc} Note2	NR_TDD_FR1_A NOTE 5	1	dBm/SRS SCS	-106	-88	-114
	NR_TDD_FR1_C					-113
	NR_TDD_FR1_D					-112.5
	NR_TDD_FR1_E					-112
	NR_TDD_FR1_A NOTE 5	2		Not applicable Note 6	-88	-111
	NR_TDD_FR1_C					-110
	NR_TDD_FR1_D					-109.5
	NR_TDD_FR1_E					-109
$\hat{E}_s/I_{ot}$ on SRS		1~2	dB	1	1	1
SRS RSRP Note3	NR_TDD_FR1_A NOTE 5	1	dBm/SRS SCS	-105	-87	-113
	NR_TDD_FR1_C					-112
	NR_TDD_FR1_D					-111.5
	NR_TDD_FR1_E					-111
	NR_TDD_FR1_A NOTE 5	2		Not applicable Note 6	-87	-110
	NR_TDD_FR1_C					-109
	NR_TDD_FR1_D					-108.5
	NR_TDD_FR1_E					-108
Io Note3	NR_TDD_FR1_A NOTE 5	1	dBm/9.36 MHz	-74.51	-56.51	-82.51
	NR_TDD_FR1_C					-81.51
	NR_TDD_FR1_D					-81.01
	NR_TDD_FR1_E					-79.51
	NR_TDD_FR1_A NOTE 5	2	dBm/38.16 MHz	Not applicable Note 6	-53.42	-76.42
	NR_TDD_FR1_C					-75.42
	NR_TDD_FR1_D					-74.92
	NR_TDD_FR1_E					-74.42
$\hat{E}_s/N_{oc}$ on SRS		1~2	dB	1	1	1
Propagation condition		1~2		AWGN	AWGN	AWGN
Antenna configuration		1~2		1x2	1x2	1x2
SRS configuration		1		SRSConf.1	SRSConf.1	SRSConf.1
		2		SRSConf.2	SRSConf.2	SRSConf.2

Note 1:	The resources for uplink transmission are assigned to the UE prior to the start of the test.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5:	The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification
Note 6:	Test 1 is not used when testing with 30kHz SSB SCS

Table A.6.7.8.1.2-3: SRS configuration parameters for FR1 SRS-RSRP accuracy

	Field	SRSConf.1	SRSConf.2
SRS-ResourceSet	srs-ResourceSetId	0	0
	srs-ResourceIdList	0	0
	resourceType	Periodic	Periodic
	Usage	Codebook	Codebook
SRS-Resource	SRS-ResourceId	0	0
	nrofSRS-Ports	Port1	Port1
	transmissionComb	n2	n2
	combOffset-n2	0	0
	cyclicShift-n2	0	0
	resourceMapping startPosition	0	0
	resourceMapping nrofSymbols	n1	n1
	resourceMapping repetitionFactor	n1	n1
	freqDomainPosition	0	0
	freqDomainShift	0	0
	freqHopping c-SRS	12	12
	freqHopping b-SRS	0	0
	freqHopping b-hop	0	0
	groupOrSequenceHopping	Neither	Neither
	resourceType	Periodic	Periodic
	periodicityAndOffset-p	sl20, 9	sl40, 19
	sequenceId	0	0

A.6.7.8.1.3 Test Requirements

The SRS-RSRP measurement accuracy shall fulfil the requirements in clauses 10.1.22.1.1.

A.6.7.8.2 SA CLI-RSSI measurement accuracy with FR1 serving cell

A.6.7.8.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CLI-RSSI measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.22.2.1 with the testing configurations for NR cells in Table A.6.7.8.2.1-1.

Table A.6.7.8.2.1-1: Applicable NR configurations for FR1 CLI-RSSI accuracy test

Config	Description
1	NR 15 kHz SRS SCS, 10 MHz bandwidth, TDD duplex mode
2	NR 30kHz SRS SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.6.7.8.2.2 Test parameters

In this set of test cases there is one cell in the test, the FR1 PSCell (Cell 1). The test parameters for the Cell 1 are given in Table A.6.7.8.2.2-1 below.

Before the test UE is configured to perform CLI-RSSI measurement. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI resource and on 1 data symbol before. The CLI-RSSI measurement resource configuration is in Table A.6.7.8.2.2-2.

Table A.6.7.8.2.2-1: FR1 test parameters for CLI-RSSI accuracy

Parameter	Config	Unit	Value
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD configuration	1		TDDConf.1.1
	2		TDDConf.2.1
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52
	2		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel	1		SR.1.1 TDD
	2		SR.2.1 TDD
RMSI CORESET Reference Channel	1		CR.1.1 TDD
	2		CR.2.1 TDD
Dedicated CORESET Reference Channel	1		CCR.1.1 TDD
	2		CCR.2.1 TDD
SSB configuration	1		SSB.1 FR1
	2		SSB.2 FR1
OCNG Patterns Note6	1~2		OP.1
TRS configuration	1		TRS.1.1 TDD
	2		TRS.1.2 TDD
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1~2		SMTC.1
Time offset between DL from serving cell and OCNG from test system	1~2	µs	17.67
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
N_{oc} on CLI-RSSI measurement resource Note2	1	dBm/15kHz	-106
	2		-106
N_{oc} on CLI-RSSI measurement resource Note2	1	dBm/ BWP SCS	-106
	2		-103

$\hat{E}_s/I_{ot}$ on CLI-RSSI measurement resource	1~2	dB	-Infinity
RSRP on CLI-RSSI measurement resource Note3	1~2	dBm/ BWP SCS	-Infinity
Io on CLI-RSSI measurement resource Note3	1	dBm/9.36 MHz	-78.05
	2	dBm/38.16 MHz	-71.96
Io on CLI-RSSI measurement resource Note3	1	dBm/1.08 MHz	-87.43
	2		-87.44
$\hat{E}_s/N_{oc}$ on CLI-RSSI measurement resource	1~2	dB	-Infinity
Propagation condition	1~2		AWGN
Antenna configuration	1~2		1x2
Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification Note 6: OCNG is not transmitted in the CLI-RSSI measurement resources.			

Table A.6.7.8.2.2-2: CLI-RSSI measurement resource configuration for FR1 CLI-RSSI accuracy

	Field	Config	SRSConf.1
CLI-RSSI measurement resource	rssi-ResourceId	1~2	0
	rssi-SCS	1	15kHz
		2	30kHz
	startPRB	1~2	0
	nrofPRBs	1	52
		2	106
	startPosition	1~2	3
	nrofSymbols	1~2	11
	rssi-PeriodicityAndOffset	1	sl20, 9
		2	sl40, 19

A.6.7.8.2.3 Test Requirements

The CLI-RSSI measurement accuracy shall fulfil the requirements in clauses 10.1.22.2.1.

A.7 NR standalone tests with one or more NR cells in FR2

A.7.1 SA: RRC_IDLE state mobility

A.7.1.1 Cell re-selection to NR

A.7.1.1.1 Cell reselection to FR2 intra-frequency NR case

A.7.1.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements specified in clause 4.2.2.3.

A.7.1.1.1.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.7.1.1.1.2-1, A.7.1.1.1.2-2 and A.7.1.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only cell 1 is already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2.

Table A.7.1.1.1.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.1.1.1.2-2: General test parameters for intra frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell1	
T2 end condition	Active cell		1, 2	Cell2	
	Neighbour cell		1, 2	Cell1	
Final condition	Active cell		1, 2	Cell1	
	Neighbour cell		1, 2	Cell2	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 µs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC.1	
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	>7	During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2
T2		s	1, 2	135	T2 needs to be defined so that cell re-selection reaction time is taken into account.
T3		s	1, 2	35	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.7.1.1.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			SR.3.1 TDD		
		2	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
		2	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
		2	CCR.3.1 TDD			CCR.3.1 TDD		
SSB configuration		1	SSB.3 FR2			SSB.7 FR2		
		2	SSB.4 FR2			SSB.8 FR2		
OCNG Pattern		1, 2	OP.4			OP.4		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-138			-138		
		2	-135			-135		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s, n}$	dB	1, 2	0			0		
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
AoA setup		1, 2	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
$\hat{E}_s/I_{ot}$	dB	1	8	-3	1.5	-infinity	1.5	-3
		2						
Beam assumption Note 4		1,2	Rough					
N_{oc} Note2	dBm/SCS	1	-93					
		2	-90					
N_{oc} Note2	dBm/15 kHz	1	-102					
		2						
$\hat{E}_s/N_{oc}$	dB	1	8	-3	1.5	-infinity	1.5	-3
		2						
SS-RSRP Note3	dBm/SCS	1	-85	-96	-91.5	-infinity	-91.5	-96
		2	-82	-93	-88.5	-infinity	-88.5	-93
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-59.37	-63.40	-62.47	-64.01	-62.47	-63.40
		2	-57.18	-62.86	-61.67	-64.01	-61.67	-62.86
Treselection	s	1, 2	0	0	0	0	0	0
SintrasearchP	dB	1, 2	50			50		
Propagation Condition		1, 2	AWGN					

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.1.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than 130 s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon cell 1.

The cell re-selection delay to an already detected cell shall be less than 27 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{detect, NR\_Intra} + T_{SI-NR}$, and to an already detected cell can be expressed as: $T_{evaluate, NR\_ intra} + T_{SI-NR}$,

Where:

T_{detect, NR_Intra} See Table 4.2.2.3-1 in clause 4.2.2.3

$T_{evaluate, NR\_ intra}$ See Table 4.2.2.3-1 in clause 4.2.2.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 129.28 s, allow 130 s for the cell re-selection delay to a newly detectable cell and 26.88 s for the cell re-selection delay to an already detected cell in the test case, which we allow 27 s.

A.7.1.1.2 Cell reselection to FR2 inter-frequency NR case

A.7.1.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements specified in clause 4.2.2.4.

A.7.1.1.2.2 Test Parameters

The test scenario comprises of 2 cells on 2 different NR carriers respectively as given in tables A.7.1.1.2.2-1, A.7.1.1.2.2-2 and A.7.1.1.2.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas and cell 2 is of higher priority than cell 1. Furthermore, UE has not registered with network for the tracking area containing cell 2.

Table A.7.1.1.2.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.7.1.1.2.2-2: General test parameters for FR2 inter frequency NR cell re-selection test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell2	The UE camps on cell 2 in the initial phase and during T1 period the UE reselects to cell 1
	Neighbour cell		1, 2	Cell1	
T1 end condition	Active cell		1, 2	Cell1	The UE shall perform reselection to cell 1 during T1
	Neighbour cells		1, 2	Cell2	
T3 end condition	Active cell		1, 2	Cell2	The UE shall perform reselection to cell 2 with higher priority during T3
	Neighbour cell		1, 2	Cell1	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			2	SSB.2 FR2	
SMTC configuration			1, 2	SMTC.1	
DRX cycle length		s	1, 2	1.28	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	35	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2	>7	During T2, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2	95	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.7.1.1.2.2-3: Cell specific test parameters for FR2 inter frequency NR cell re-selection test case in AWGN

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
TDD configuration		1, 2	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1, 2	SR.3.1 TDD			SR.3.1 TDD		
RMSI CORESET parameters		1, 2	CR.3.1 TDD			CR.3.1 TDD		
RMSI CORESET RMC configuration		1, 2	CCR.3.1 TDD			CCR.3.1 TDD		
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1, 2	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1, 2	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1, 2	SSB			SSB		
Qrxlevmin	dBm/SCS	1	-140			-140		
		2	-137			-137		
Pcompensation	dB	1, 2	0			0		
$Qhyst_s$	dB	1, 2	0			0		
$Qoffset_{s, n}$	dB	1, 2	0			0		
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP			SS-RSRP		
AoA setup		1, 2	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
Beam assumption Note 4		1,2	Rough			Rough		
$\hat{E}_s/I_{ot}$	dB	1	10.5	10.5	8	-10.5	-infinity	8.5
		2						
N_{oc} Note2	dBm/SCS	1	-93			-93		
		2	-90			-90		
N_{oc} Note2	dBm/15 kHz	1	-102			-102		
		2						
$\hat{E}_s/N_{oc}$	dB	1	10.5	10.5	8	-10.5	-infinity	8.5
		2						
SS-RSRP Note3	dBm/SCS	1	-83.5-	-83.5	-85	-103.5	-infinity	-84.5
		2	-80.5	-80.5	-82	-100.5	-infinity	-80.5
Io	dBm/95.04 MHz	1, 2	-54.05	-54.05	-55.37	-63.64	-54.01	-54.94
Treselection	s	1, 2	-54.05	-54.05	-55.37	-63.64	-54.01	-54.94
SnonintrasearchP	dB	1, 2	50			50		
$Thresh_{x, highP}$	dB	1, 2	48			48		
$Thresh_{serving, lowP}$	dB	1, 2	44			44		
$Thresh_{x, lowP}$	dB	1, 2	50			50		
Propagation Condition		1, 2	AWGN			AWGN		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.1.1.2.3 Test Requirements

The cell reselection delay to a higher priority cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon cell 2.

The cell re-selection delay to a higher priority cell shall be less than 87 s.

The cell reselection delay to a lower priority cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon cell 1.

The cell re-selection delay to a lower priority cell shall be less than 27 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher\_priority\_search} + T_{evaluate, NR\_ inter} + T_{SI-NR}$, and to a lower priority cell can be expressed as: $T_{evaluate, NR\_ inter} + T_{SI-NR}$,

Where:

$T_{higher\_priority\_search}$ See clause 4.2.2.7

$T_{evaluate, NR\_ inter}$ See Table 4.2.2.4-1 in clause 4.2.2.4

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 86.88 s, allow 87 s for the cell re-selection delay to a higher priority cell and 26.88 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 27 s.

A.7.1.1.3 Cell reselection to FR2 intra-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.7.1.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for UE configured with relaxed measurement criterion specified in clause 4.2.2.9.2.

A.7.1.1.3.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.7.1.1.3.2-1, A.7.1.1.3.2-2 and A.7.1.1.3.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. During T1, only criteria *lowMobilityEvalutation* is configured and fulfilled, where ($Srxlev_{Ref}$ – Srxlev) < $S_{SearchDeltaP}$. UE has not registered with network for the tracking area containing cell2.

Table A.7.1.1.3.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.1.1.3.2-2: General test parameters for FR2 intra-frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell2	
	Neighbour cells		1, 2	Cell1	
T1 end condition	Active cell		1, 2	Cell1	
	Neighbour cells		1, 2	Cell2	
Final condition	Active cell		1, 2	Cell2	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC pattern 1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
$S_{SearchDeltaP}$		dB	1,2	6	Threshold for *lowMobilityEvalutation* criterion.
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	35	
T2		s	1, 2	35	

Table A.7.1.1.3.2-3: Cell specific test parameters for FR2 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		SR.3.1 TDD	
		2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
		2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
		2	CCR.3.1 TDD		CCR.3.1 TDD	
SSB configuration		1	SSB.3 FR2		SSB.7 FR2	
		2	SSB.4 FR2		SSB.8 FR2	
OCNG Pattern		1, 2	OP.4		OP.4	
Initial DL BWP configuration		1, 2	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s, n}$	dB	1, 2	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption Note 4		1,2	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1	8	8	-3	8
		2				
N_{oc} Note2	dBm/SCS	1	-93			
		2	-90			
N_{oc} Note2	dBm/15 kHz	1	-102			
		2				
$\hat{E}_s/N_{oc}$	dB	1	8	8	-3	8
		2				
SS-RSRP Note3	dBm/SCS	1	-85	-85	-96	-85
		2	-82	-82	-93	-82
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-55.37	-55.37	-62.25	-55.37
		2	-52.37	-52.37	-59.25	-52.37

Treselection	s	1, 2	0	0	0	0
SintrasearchP	dB	1, 2	50		50	
Propagation Condition		1, 2	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.1.1.3.3 Test Requirements

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 79 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: $T_{evaluate, NR\_Intra} + T_{SI-NR}$,

Where:

$T_{evaluate, NR\_Intra}$ See Table 4.2.2.9.1-1 in clause 4.2.2.9,

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 78.08 s, allow 79s for the cell re-selection delay to an already detected cell for UE fulfilling low mobility criterion in the test case.

A.7.1.1.4 Cell reselection to FR2 intra-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.7.1.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for UE configured with relaxed measurement criterion specified in clause 4.2.2.9.3.

A.7.1.1.4.2 Test Parameters

The test scenario comprises of 1 NR carrier and 2 cells as given in tables A.7.1.1.4.2-1, A.7.1.1.4.2-2 and A.7.1.1.4.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. During T1, only criteria *cellEdgeEvaluation* is configured and fulfilled, where Srxlev $\leq S_{nonIntraSearchP}$. UE has not registered with network for the tracking area containing cell2.

Table A.7.1.1.4.2-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

Table A.7.1.1.4.2-2: General test parameters for FR2 intra-frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell2	
	Neighbour cells		1, 2	Cell1	
T1 end condition	Active cell		1, 2	Cell1	
	Neighbour cells		1, 2	Cell2	
Final condition	Active cell		1, 2	Cell2	
RF Channel Number			1, 2	1	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SMTC configuration			1, 2	SMTC pattern 1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
$S_{SearchThresholdP}$		dB	1,2	20	Threshold for cellEdgeEvaluation
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	100	
T2		s	1, 2	100	

Table A.7.1.1.4.2-3: Cell specific test parameters for FR2 intra-frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD		SR.3.1 TDD	
		2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD		CR.3.1 TDD	
		2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD		CCR.3.1 TDD	
		2	CCR.3.1 TDD		CCR.3.1 TDD	
SSB configuration		1	SSB.3 FR2		SSB.7 FR2	
		2	SSB.4 FR2		SSB.8 FR2	
OCNG Pattern		1, 2	OP.4		OP.4	
Initial DL BWP configuration		1, 2	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s,n}$	dB	1, 2	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption Note 4		1,2	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1	8	8	-3	8
		2				
N_{oc} Note2	dBm/SCS	1	-93			
		2	-90			
N_{oc} Note2	dBm/15 kHz	1	-102			
		2				
$\hat{E}_s/N_{oc}$	dB	1	8	8	-3	8
		2				
SS-RSRP Note3	dBm/SCS	1	-85	-85	-96	-85
		2	-82	-82	-93	-82
Io on SSB symbols of each cell	dBm/95.04 MHz	1	-55.37	-55.37	-62.25	-55.37
		2	-52.37	-52.37	-59.25	-52.37

Treselection	s	1, 2	0	0	0	0
SintrasearchP	dB	1, 2	[50]		[50]	
Propagation Condition		1, 2	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.1.1.4.3 Test Requirements

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected cell shall be less than 79 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to an already detected cell can be expressed as: $T_{evaluate,\ NR\_Intra} + T_{SI\text{-}NR}$,

Where:

$T_{evaluate,\ NR\_Intra}$ See Table 4.2.2.9.3-1 in clause 4.2.2.9,

$T_{SI\text{-}NR}$ Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 78.08 s, allow 79s for the cell re-selection delay to -an already detected cell for UE fulfilling not-at-cell edge criterion in the test case.

A.7.1.1.5 Cell reselection to FR2 inter-frequency NR case for UE fulfilling low mobility relaxed measurement criterion

A.7.1.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for UE fulfilling low mobility criterion specified in clause 4.2.2.10.2.

A.7.1.1.5.2 Test Parameters

The test scenario comprises of 2 cells (Cell 1 and Cell 2) on 2 different NR carriers respectively as given in tables A.7.1.1.5.2-1, A.7.1.1.5.2-2 and A.7.1.1.5.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. Cell 2 is of higher priority than Cell 1. The UE is configured with l*owMobilityEvalutation* criterion [2].

Table A.7.1.1.5.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.7.1.1.5.2-2: General test parameters for FR2 inter frequency NR cell re-selection test case for UE fulfilling low mobility criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell2	The UE camps on cell2 and fulfils low mobility (*lowMobilityEvalutation* [2]) criterion.
	Neighbour cell		1, 2	Cell1	
T1 final condition	Active cell		1, 2	Cell1	The UE reselects to low priority cell1 during T1
	Neighbour cell		1, 2	Cell2	
T2 final condition	Active cell		1, 2	Cell2	The UE reselects to high priority cell2 during T2
	Neighbour cell			Cell1	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			2	SSB.2 FR2	
SMTC configuration			1, 2	SMTC pattern 1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	85	T1 needs to be long enough to allow cell re-selection to already known cell1
T2		s	1, 2	[85]	T2 needs to be long enough to allow cell re-selection to already known cell2

Table A.7.1.1.5.2-3: Cell specific test parameters for FR2 inter frequency NR cell re-selection test case in AWGN for UE fulfilling low mobility criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET parameters		1, 2	CR.3.1 TDD		CR.3.1 TDD	
RMSI CORESET RMC configuration		1, 2	CCR.3.1 TDD		CCR.3.1 TDD	
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s, n}$	dB	1, 2	0		0	
Cell_selection_and_reselection_quality_measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption Note 4		1, 2	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1, 2	8	[8]	-3	[8]
N_{oc} Note2	dBm/SCS	1	-93		-93	
		2	-90		-90	
N_{oc} Note2	dBm/15 kHz	1, 2	-102		-102	
$\hat{E}_s/N_{oc}$	dB	1, 2	8	[8]	-3	[8]
SS-RSRP Note3	dBm/SCS	1	-85	[-85]	-96	[-85]
		2	-82	[-82]	-93	[-82]
Io	dBm/95.04 MHz	1	-55.37	[-55.37]	-62.25	[-55.37]
		2	-52.37	[-52.37]	-59.25	[-52.37]
TreselectionNR	s	1, 2	0		0	
SnonintrasearchP	dB	1, 2	50		Not sent	
$S_{SearchDeltaP}$	dB	1, 2	6		6	
$T_{SearchDeltaP}$	s	1, 2	300		300	
$Thresh_{x, high}$	dB	1, 2	[48]		[48]	
$Thresh_{serving, low}$	dB	1, 2	[44]		[44]	
$Thresh_{x, low}$	dB	1, 2	[50]		[50]	
Propagation Condition		1, 2	AWGN		AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.1.1.5.3 Test Requirements

The cell reselection delay to an already detected low priority cell (Cell 1) for UE fulfilling low mobility criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected low priority cell, Cell 1, shall be less than 79 s.

The cell reselection delay to an already detected high priority cell (Cell 2) for UE fulfilling low mobility criterion is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected high priority cell, Cell 2, shall be less than [79] s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE 1: The cell re-selection delay to an already detected low priority cell can be expressed as: $T_{evaluate, NR\_ inter} + T_{SI-NR}$

NOTE 2: The cell re-selection delay to an already detected higher priority cell can be expressed as: $T_{evaluate, NR\_ inter} + T_{SI-NR}$

Where:

$T_{evaluate, NR\_ inter}$ See Table 4.2.2.10.2-1 in clause 4.2.2.10.2

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 78.08 s, allow 79 s for the cell re-selection delay to an already detected low priority cell for UE fulfilling low mobility criterion in the test case.

This gives a total of [78.08] s, allow [79] s for the cell re-selection delay to an already detected high priority cell for UE fulfilling low mobility criterion in the test case.

A.7.1.1.6 Cell reselection to FR2 inter-frequency NR case for UE fulfilling not-at-cell edge relaxed measurement criterion

A.7.1.1.6.1 Test Purpose and Environment

This test is to verify the requirement for the inter frequency NR cell reselection requirements for UE fulfilling not-at-cell edge criterion specified in clause 4.2.2.10.3.

A.7.1.1.6.2 Test Parameters

The test scenario comprises of 2 cells (Cell 1 and Cell 2) on 2 different NR carriers respectively as given in tables A.7.1.1.6.2-1, A.7.1.1.6.2-2 and A.7.1.1.6.2-3. The test consists of two successive time periods, with time duration of T1 and T2 respectively. Both cell 1 and cell 2 are already identified by the UE prior to the start of the test. Cell 1 and Cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing Cell 2. Cell 2 is of higher priority than Cell 1. The UE is configured with *cellEdgeEvaluation* criterion [2].

Table A.7.1.1.6.2-1: Supported test configurations

Configuration	Description for serving cell	Description for target cell
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.		

Table A.7.1.1.6.2-2: General test parameters for FR2 inter frequency NR cell re-selection test case for UE fulfilling not-at-cell edge criterion

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2	Cell2	The UE camps on cell2 and fulfils not-at-cell edge (*cellEdgeEvaluation* [2]) criterion.
	Neighbour cell		1, 2	Cell1	
T1 final condition	Active cell		1, 2	Cell1	The UE reselects to low priority cell1 during T1
	Neighbour cell		1, 2	Cell2	
T2 final condition	Active cell		1, 2	Cell2	The UE reselects to high priority cell2 during T2
	Neighbour cell		1, 2	Cell1	
RF Channel Number			1, 2	1, 2	
Time offset between cells			1, 2	3 μs	Synchronous cells
Access Barring Information		-	1, 2	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			2	SSB.2 FR2	
SMTC configuration			1, 2	SMTC pattern 1	
DRX cycle length		s	1, 2	0.64	The value shall be used for all cells in the test.
PRACH configuration index			1, 2	190	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
rangeToBestCell			1, 2	Not configured	
T1		s	1, 2	85	T1 needs to be long enough to allow cell re-selection to already known cell.
T2		s	1, 2	[85]	T2 needs to be long enough to allow cell re-selection to already known cell.

Table A.7.1.1.6.2-3: Cell specific test parameters for FR2 inter frequency NR cell re-selection test case in AWGN for UE fulfilling not-at-cell edge criterion

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2

TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET parameters		1, 2	CR.3.1 TDD		CR.3.1 TDD	
RMSI CORESET RMC configuration		1, 2	CCR.3.1 TDD		CCR.3.1 TDD	
OCNG Pattern		1, 2	OP.1 defined in A.3.2.1		OP.1 defined in A.3.2.1	
Initial DL BWP configuration		1, 2	DLBWP.0.1		DLBWP.0.1	
Initial UL BWP configuration		1, 2	ULBWP.0.1		ULBWP.0.1	
RLM-RS		1, 2	SSB		SSB	
Qrxlevmin	dBm/SCS	1	-140		-140	
		2	-137		-137	
Pcompensation	dB	1, 2	0		0	
$Qhyst_s$	dB	1, 2	0		0	
$Qoffset_{s,n}$	dB	1, 2	0		0	
Cell_selection_and_ reselection_quality_ measurement		1, 2	SS-RSRP		SS-RSRP	
AoA setup		1, 2	Setup 1 defined in A.3.15.1		Setup 1 defined in A.3.15.1	
Beam assumption Note 4		1, 2	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1, 2	8	8	-3	8
N_{oc} Note2	dBm/SCS	1	-93		-93	
		2	-90		-90	
N_{oc} Note2	dBm/15 kHz	1, 2	-102		-102	
$\hat{E}_s/N_{oc}$	dB	1, 2	8	[8]	-3	[8]
SS-RSRP Note3	dBm/SCS	1	-85	[-85]	-96	[-85]
		2	-82	[-82]	-93	[-82]
Io	dBm/95.04 MHz	1	-55.37	[-55.37]	-62.25	[-55.37]
		2	-52.37	[-52.37]	-59.25	[-52.37]
TreselectionNR	s	1, 2	0		0	
SnonintrasearchP	dB	1, 2	50		Not sent	
$S_{SearchDeltaP}$	dB	1, 2	6		6	
$T_{SearchDeltaP}$	s	1, 2	300		300	
$Thresh_{x, high}$	dB	1, 2	[48]		[48]	
$Thresh_{serving, low}$	dB	1, 2	[44]		[44]	
$Thresh_{x, low}$	dB	1, 2	[50]		[50]	
Propagation Condition		1, 2	AWGN		AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.1.1.6.3 Test Requirements

The cell reselection delay to an already detected low priority cell (Cell 1) for UE fulfilling not-at-cell edge criterion is defined as the time from the beginning of time period T1, to the moment when the UE camps on Cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 1.

The cell re-selection delay to an already detected low priority cell, Cell 1, shall be less than 79 s.

The cell reselection delay to an already detected high priority cell (Cell 2) for UE fulfilling not-at-cell edge criterion is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Tracking Area Update procedure on Cell 2.

The cell re-selection delay to an already detected high priority cell, Cell 2, shall be less than [79] s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE 1: The cell re-selection delay to an already detected low priority cell can be expressed as: $T_{evaluate, NR\_ inter} + T_{SI-NR}$

NOTE 2: The cell re-selection delay to an already detected higher priority cell can be expressed as: $T_{higher\_priority\_search} + T_{evaluate, NR\_ inter} + T_{SI-NR}$

Where:

$T_{evaluate, NR\_ inter}$ See Table 4.2.2.10.3-1 in clause 4.2.2.10.3

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280ms is assumed in this test case.

This gives a total of 78.08 s, allow 79 s for the cell re-selection delay to an already detected low priority cell for UE fulfilling not-at-cell edge criterion in the test case.

This gives a total of [78.08] s, allow [139] s for the cell re-selection delay to an already detected high priority cell for UE fulfilling not-at-cell edge criterion in the test case.

A.7.2 SA: RRC_INACTIVE state mobility

A.7.3 RRC_CONNECTED state mobility

A.7.3.1 Handover

A.7.3.1.1 Inter-frequency handover from FR1 to FR2; unknown target cell

A.7.3.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR1-NR FR2 inter frequency handover requirements specified in clause 6.1.1.5.

A.7.3.1.1.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.1.2-2, and A.7.3.1.1.2-3.

The test scenario comprises of two carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.1.2-1: Inter-frequency handover from FR1 to FR2 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.1.2-2: General test parameters Inter-frequency handover from FR1 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.1.2-3: Cell specific test parameters for NR FR1-FR2 Inter frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			N/A		Rough	
AoA setup			NA		Setup TBD as defined in A.3.15	
NR RF Channel Number			**1**		**2**	
Duplex mode	Config 1		FDD		TDD	
	Config 2,3		TDD		TDD	
TDD configuration	Config 1		Not Applicable		TDDConf.3.1	
	Config 2		TDDConf.1.1		TDDConf.3.1	
	Config 3		TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
	Config 2		10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
	Config 3		40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
	Config 2		10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
	Config 3		40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD		SR3.1 TDD	
	Config 2		SR.1.1 TDD		SR3.1 TDD	
	Config 3		SR2.1 TDD		SR3.1 TDD	
CORESET Reference Channel	Config 1		CR.1.1 FDD		CR3.1 TDD	
	Config 2		CR.1.1 TDD		CR3.1 TDD	
	Config 3		CR2.1 TDD		CR3.1 TDD	
OCNG Patterns			OCNG pattern 1			
SSB configuration	Config 1,2		SSB.1 FR1		SSB.1 FR2	
	Config 3		SSB.2 FR1		SSB.1 FR2	
SMTC configuration	Config 1,2		SMTC.1		SMTC.1	
	Config 3		SMTC.2		SMTC.1	
SMTC configuration	Config 1,2		SMTC.1		SMTC.1	
	Config 3		SMTC.2		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz		120 kHz	
	Config 3		30 kHz		120 kHz	
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz		120 kHz	
	Config 3		30 kHz		120 kHz	
PRACH configuration			FR1 PRACH configuration 1		FR2 PRACH configuration 1	
TRS configuration	Config 1		TRS.1.1 FDD		TRS.2.1 TDD	
	Config 2		TRS.1.1 TDD		TRS.2.1 TDD	
	Config 3		TRS.1.2 TDD		TRS.2.1 TDD	
TCI configuration			N/A		CSI-RS.Config.0	
BWP configuraiton	Initial DL BWP		DLBWP.0.1		DLBWP.0.1	
	Dedicated DL BWP		DLBWP.1.1		DLBWP.1.1	
	Initial UL BWP		ULBWP.0.1		ULBWP.0.1	
	Dedicated UL BWP		ULBWP.1.1		ULBWP.1.1	
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						

EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2		dBm/15kHz	NA Link only, see clause A.3.7A	-104.7	
N_{oc} Note2	Config 1,2	dBm/SCS		-95.7	
	Config 3			-95.7	
$\hat{E}_s/I_{ot}$		dB		-Infinity	10
$\hat{E}_s/N_{oc}$		dB		-Infinity	10
Io Note3	Config 1,2	dBm/BW		-66.7	-55.4
	Config 3	dBm/BW		-66.7	-55.4
Propagation condition		-		AWGN	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.3.1.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 572 ms from the beginning of time period T2. The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = [10] ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 562 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.5.2.

This gives a total of 572 ms.

A.7.3.1.2 Intra-frequency handover from FR2 to FR2; unknown target cell

A.7.3.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 intra frequency handover requirements specified in clause 6.1.1.4.

A.7.3.1.2.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.2.2-2, and A.7.3.1.2.2-3.

The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.2.2-1: Intra-frequency handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.1.2.2-2: General test parameters Intra-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.2.2-3: Cell specific test parameters for NR FR2-FR2 Intra frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		Rough	
AoA setup			Setup TBD as defined in A.3.15			
NR RF Channel Number			1		1	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{RB,c}$ = 66			
BWP BW		MHz	100: $N_{RB,c}$ = 66			
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
CORESET Reference Channel			CR3.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB.1 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
TCI configuration			CSI-RS.Config.0			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-104.7		-104.7	
N_{oc} Note2	Config 1,2	dBm/SCS	-95.7		-95.7	
	Config 3		-95.7		-95.7	
$\hat{E}_s/I_{ot}$		dB	6	-1.8	-Infinity	0
$\hat{E}_s/N_{oc}$		dB	6	6	-Infinity	7
Io[Note3]	Config 1,2	dBm/BW	-59.7	-56.7	-59.7	-56.7
	Config 3	dBm/BW	-59.7	-56.7	-59.7	-56.7
Propagation condition		-	AWGN			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

Note 6:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.1.2.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 232 ms from the beginning of time period T2. The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 222 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.4.2.

This gives a total of 232 ms.

A.7.3.1.3 Inter-frequency handover from FR2 to FR2; unknown target cell

A.7.3.1.3.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 inter frequency handover requirements specified in clause 6.1.1.4.

A.7.3.1.3.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.3.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.3.2-2, and A.7.3.1.3.2-3.

The test scenario comprises of carriers and one cell on each carrier. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. Starting T2, cell 2 becomes detectable and the UE receives a RRC handover command from the network. The start of T2 is the instant when the last TTI containing the RRC message implying handover is sent to the UE.

Table A.7.3.1.3.2-1: Inter-frequency handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.1.3.2-2: General test parameters Inter-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Offset		dB	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤10	

Table A.7.3.1.3.2-3: Cell specific test parameters for NR FR2-FR2 Inter frequency handover test case

Parameter	Unit	Cell 1		Cell 2	
		T1	T2	T1	T2

Assumption for UE beams Note 6			Rough		Rough	
AoA setup			Setup TBD as defined in A.3.15			
NR RF Channel Number			**1**		**2**	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{RB,c}$ = 66			
BWP BW		MHz	100: $N_{RB,c}$ = 66			
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
CORESET Reference Channel			CR3.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB.1 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
TCI configuration			CSI-RS.Config.0			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-104.7		-104.7	
N_{oc} Note2	Config 1,2	dBm/SCS	-95.7		-95.7	
	Config 3		-95.7		-95.7	
$\hat{E}_s/I_{ot}$		dB	5	5	-Infinity	5
$\hat{E}_s/N_{oc}$		dB	5	5	-Infinity	5
Io Note3	Config 1,2	dBm/ BW	-60.5	-60.5	-66.7	-60.5
	Config 3	dBm/ BW	-60.5	-60.5	-66.7	-60.5
Propagation condition		-	AWGN			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.1.3.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 552 ms from the beginning of time period T2.
The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 10 ms and is specified in clause 12 in TS 38.331 [2].

$T_{interrupt}$ = 542 ms in the test. $T_{interrupt}$ is defined in clause 6.1.1.4.2.

This gives a total of 552 ms.

A.7.3.1.4 Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2

A.7.3.1.4.1 Test Purpose and Environment

This test is to verify the requirement for the FR1-to-FR2 Inter-band inter-frequency synchronous DAPS handover requirements specified in clause 6.1.3.4.

A.7.3.1.4.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.4.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.4.2-2, A.7.3.1.4.2-3 and A.7.3.1.4.2-4.

The test scenario comprises of two bands each with one cell. The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively.

Before the start of T1, the UE is connected to Cell 1 (source PCell) on radio channel 1 but is not aware of Cell 2 (neighbour cell) on radio channel 2. During T1, the UE shall not have any timing information of Cell 2.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A3 is configured for neighbour cell (Cell 2), and the UE is configured with the measurement gaps (gap pattern ID # 0). Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing the RRC message implying DAPS handover to Cell 2 (target PCell) is sent to the UE. During T3, the UE shall be able to perform random access to Cell 2. DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission. After the RACH procedure is completed, the test system shall send a RRC message to the UE to release Cell 1 (source cell) on radio channel 1.

The start of T4 is the instant when the last TTI containing the RRC message implying source cell release is sent to the UE. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stops to send CSI report to the source cell.

Table A.7.3.1.4.2-1: Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.4.2-2: General test parameters for Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells		μs	33	Synchronous cells
T1		s	5	
T2		s	<5	
T3		s	<0.5	
T4		ms	10+$T_{interrupt2}$	$T_{interrupt2}$ as defined in Table 6.1.3.4.2-2 for synchronous DAPS HO
T5		ms	100	

Table A.7.3.1.4.2-3: Cell specific test parameters for Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2 (Cell 1 in FR1)

Parameter		Unit	Cell 1				
			T1	T2	T3		
NR RF Channel Number			1				
Duplex mode	Config 1		FDD				
	Config 2,3		TDD				
TDD configuration	Config 1		Not Applicable				
	Config 2		TDDConf.1.1				
	Config 3		TDDConf.2.1				
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52				
	Config 2		10: $N_{RB,c}$ = 52				
	Config 3		40: $N_{RB,c}$ = 106				
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52				
	Config 2		10: $N_{RB,c}$ = 52				
	Config 3		40: $N_{RB,c}$ = 106				
TRS configuration	Config 1		TRS.1.1 FDD				
	Config 2		TRS.1.1 TDD				
	Config 3		TRS.1.2 TDD				
DRx Cycle		ms	Not Applicable				
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD				
	Config 2		SR.1.1 TDD				
	Config 3		SR2.1 TDD				
CORESET Reference Channel	Config 1		CR.1.1 FDD				
	Config 2		CR.1.1 TDD				
	Config 3		CR2.1 TDD				
OCNG Patterns			OCNG pattern 1				
SSB Configuration	Config 1,2		SSB.1 FR1				
	Config 3		SSB.2 FR1				
SMTC Configuration	Config 1,2		SMTC.1				
	Config 3		SMTC.2				
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz				
	Config 3		30 kHz				
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz				
	Config 3		30 kHz				
PRACH configuration			FR1 PRACH configuration 2				
BWP	Initial DL BWP		DLBWP.0.1				
	Dedicated DL BWP		DLBWP.1.3				
	Initial UL BWP		ULBWP.0.1				
	Dedicated UL BWP		ULBWP.1.3				
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15kHz	NA Link only, see clause A.3.7A				
N_{oc} Note2	Config 1,2	dBm/SCS					
	Config 3						
$\hat{E}_s/I_{ot}$		dB					

$\hat{E}_s/N_{oc}$		dB	
Io[Note3]	Config 1,2	dBm/ 9.36MHz	
	Config 3	dBm/ 38.16MHz	
Propagation condition		-	AWGN
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

Table A.7.3.1.4.2-4: Cell specific test parameters for Inter-band inter-frequency synchronous DAPS handover from FR1 to FR2 (Cell 2 in FR2)

Parameter		Unit	Cell 2				
			T1	T2	T3	T4	T5
NR RF Channel Number			2				
Duplex mode	Config 1,2,3		TDD				
TDD configuration	Config 1,2,3		TDDConf.3.1				
$BW_{channel}$	Config 1,2,3	MHz	100: $N_{RB,c}$ = 66				
BWP BW	Config 1,2,3	MHz	100: $N_{RB,c}$ = 66				
TRS configuration	Config 1,2,3		TRS.2.1 TDD				
DRX Cycle		ms	Not Applicable				
PDSCH Reference measurement channel	Config 1,2,3		SR3.1 TDD				
CORESET Reference Channel	Config 1,2,3		CR3.1 TDD				
OCNG Patterns			OCNG pattern 1				
SSB Configuration	Config 1,2,3		SSB.1 FR2				
SMTC Configuration			SMTC.1				
PDSCH/PDCCH subcarrier spacing	Config 1,2,3	kHz	120 kHz				
PUCCH/PUSCH subcarrier spacing	Config 1,2,3	kHz	120 kHz				
PRACH configuration			FR2 PRACH configuration 2				
TCI configuration			CSI-RS.Config.0				
BWP	Initial DL BWP		DLBWP.0.1				
	Dedicated DL BWP		DLBWP.1.3				
	Initial UL BWP		ULBWP.0.1				
	Dedicated UL BWP		ULBWP.1.3				
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15kHz	-104.7	-104.7	-104.7	-104.7	-104.7
N_{oc} Note2		dBm/SCS	-95.7	-95.7	-95.7	-95.7	-95.7
$\hat{E}_s/I_{ot}$		dB	-Infinity	10	10	10	10
$\hat{E}_s/N_{oc}$		dB	-Infinity	10	10	10	10
Io Note3		dBm/ 9.36MHz	-66.7	-55.4	-55.4	-55.4	-55.4
Propagation condition		-	AWGN				

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.3.1.4.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 92 ms from the beginning of time period T3. During $D_{handover1}$, the interruption on Cell 1 shall not exceed $T_{interrupt1}$ as defined in Table 6.1.3.4.2-1 for synchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay $D_{handover1}$ can be expressed as: $T_{RRC\_procedure} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 40 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 92 ms.

The UE shall complete to release Cell 1 less than (10 ms + $T_{interrupt2}$) from the beginning of time period T4. During $D_{handover2}$, the interruption on Cell 2 shall not exceed $T_{interrupt2}$ as defined in Table 6.1.3.4.2-2 for synchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay $D_{handover2}$ can be expressed as: $T_{RRC\_procedure} + T_{interrupt2}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

A.7.3.1.5 Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2

A.7.3.1.5.1 Test Purpose and Environment

This test is to verify the requirement for the FR1-to-FR2 Inter-band inter-frequency asynchronous DAPS handover requirements specified in clause 6.1.3.4.

A.7.3.1.5.2 Test Parameters

Supported test configurations are shown in table A.7.3.1.5.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.1.5.2-2, A.7.3.1.5.2-3 and A.7.3.1.5.2-4.

The test scenario comprises of two bands each with one cell. The test consists of five successive time periods, with time durations of T1, T2, T3, T4 and T5 respectively.

Before the start of T1, the UE is connected to Cell 1 (source PCell) on radio channel 1 but is not aware of Cell 2 (neighbour cell) on radio channel 2. During T1, the UE shall not have any timing information of Cell 2.

Before the start of T2, the UE in the measurement control information that event-triggered reporting with Event A3 is configured for neighbour cell (Cell 2), and the UE is configured with the measurement gaps (gap pattern ID # 0). Starting T2, Cell 2 becomes known to the UE. During T2, the UE shall report Event A3. After receiving the Event A3, the test system shall send a RRC message implying DAPS handover to the UE.

The start of T3 is the instant when the last TTI containing the RRC message implying DAPS handover to Cell 2 (target PCell) is sent to the UE. During T3, the UE shall be able to perform random access to Cell 2. DL schedule and UL feedback to cell 1 shall be avoided when UE is required to perform DL reception or UL transmission in PRACH procedure in cell 2, except preamble transmission. After the RACH procedure is completed, the test system shall send a RRC message to the UE to release Cell 1 (source cell) on radio channel 1.

The start of T4 is the instant when the last TTI containing the RRC message implying source cell release is sent to the UE. During T4, the UE shall perform source cell release.

Starting T5, the UE shall stops to send CSI report to the source cell.

Table A.7.3.1.5.2-1: Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2 test configurations

Config	Description
1	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	Source cell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	Source cell: NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.7.3.1.5.2-2: General test parameters for Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Offset		dBm	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells		μs	62.5	Asynchronous cells
T1		s	5	
T2		s	<5	
T3		s	<0.5	
T4		ms	$10+T_{interrupt2}$	$T_{interrupt2}$ as defined in Table 6.1.3.4.2-2 for asynchronous DAPS HO.
T5		ms	100	

Table A.7.3.1.5.2-3: Cell specific test parameters for Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2 (Cell 1 in FR1)

Parameter		Unit	Cell 1				
			T1	T2	T3	T4	T5
NR RF Channel Number			1				
Duplex mode	Config 1		FDD				
	Config 2,3		TDD				
TDD configuration	Config 1		Not Applicable				
	Config 2		TDDConf.1.1				
	Config 3		TDDConf.2.1				
$BW_{channel}$	Config 1	MHz	10: $N_{RB,c}$ = 52				
	Config 2		10: $N_{RB,c}$ = 52				
	Config 3		40: $N_{RB,c}$ = 106				
BWP BW	Config 1	MHz	10: $N_{RB,c}$ = 52				
	Config 2		10: $N_{RB,c}$ = 52				
	Config 3		40: $N_{RB,c}$ = 106				
TRS configuration	Config 1		TRS.1.1 FDD				
	Config 2		TRS.1.1 TDD				
	Config 3		TRS.1.2 TDD				
DRx Cycle		ms	Not Applicable				
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD				
	Config 2		SR.1.1 TDD				
	Config 3		SR2.1 TDD				
CORESET Reference Channel	Config 1		CR.1.1 FDD				
	Config 2		CR.1.1 TDD				
	Config 3		CR2.1 TDD				
OCNG Patterns			OCNG pattern 1				
SSB Configuration	Config 1,2		SSB.1 FR1				
	Config 3		SSB.2 FR1				
SMTC Configuration	Config 1,2		SMTC.1				
	Config 3		SMTC.2				
PDSCH/PDCCH subcarrier spacing	Config 1,2	kHz	15 kHz				
	Config 3		30 kHz				
PUCCH/PUSCH subcarrier spacing	Config 1,2	kHz	15 kHz				
	Config 3		30 kHz				
PRACH configuration			FR1 PRACH configuration 2				
BWP	Initial DL BWP		DLBWP.0.1				
	Dedicated DL BWP		DLBWP.1.3				
	Initial UL BWP		ULBWP.0.1				
	Dedicated UL BWP		ULBWP.1.3				
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15kHz	NA Link only, see clause A.3.7A				
N_{oc} Note2	Config 1,2	dBm/SCS					
	Config 3						

$\hat{E}_s/I_{ot}$		dB	
$\hat{E}_s/N_{oc}$		dB	
Io[Note3]	Config 1,2	dBm/ 9.36MHz	
	Config 3	dBm/ 38.16MHz	
Propagation condition		-	AWGN
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

Table A.7.3.1.5.2-4: Cell specific test parameters for Inter-band inter-frequency asynchronous DAPS handover from FR1 to FR2 (Cell 2 in FR2)

Parameter		Unit	Cell 2				
			T1	T2	T3	T4	T5
NR RF Channel Number			2				
Duplex mode	Config 1,2,3		TDD				
TDD configuration	Config 1,2,3		TDDConf.3.1				
$BW_{channel}$	Config 1,2,3	MHz	100: $N_{RB,c}$ = 66				
BWP BW	Config 1,2,3	MHz	100: $N_{RB,c}$ = 66				
TRS configuration	Config 1,2,3		TRS.2.1 TDD				
DRX Cycle		ms	Not Applicable				
PDSCH Reference measurement channel	Config 1,2,3		SR3.1 TDD				
CORESET Reference Channel	Config 1,2,3		CR3.1 TDD				
OCNG Patterns			OCNG pattern 1				
SSB Configuration	Config 1,2,3		SSB.1 FR2				
SMTC Configuration			SMTC.1				
PDSCH/PDCCH subcarrier spacing	Config 1,2,3	kHz	120 kHz				
PUCCH/PUSCH subcarrier spacing	Config 1,2,3	kHz	120 kHz				
PRACH configuration			FR2 PRACH configuration 2				
TCI configuration			CSI-RS.Config.0				
BWP	Initial DL BWP		DLBWP.0.1				
	Dedicated DL BWP		DLBWP.1.3				
	Initial UL BWP		ULBWP.0.1				
	Dedicated UL BWP		ULBWP.1.3				
EPRE ratio of PSS to SSS		dB	0				
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15kHz	-104.7	-104.7	-104.7	-104.7	-104.7
N_{oc} Note2		dBm/SCS	-95.7	-95.7	-95.7	-95.7	-95.7
$\hat{E}_s/I_{ot}$		dB	-Infinity	10	10	10	10
$\hat{E}_s/N_{oc}$		dB	-Infinity	10	10	10	10
Io Note3		dBm/ 9.36MHz	-66.7	-55.4	-55.4	-55.4	-55.4
Propagation condition		-	AWGN				

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone.

A.7.3.1.5.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 92 ms from the beginning of time period T3. During $D_{handover1}$, the interruption on Cell 1 shall not exceed $T_{interrupt1}$ as defined in Table 6.1.3.4.2-1 for asynchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay $D_{handover1}$ can be expressed as: $T_{RRC\_procedure} + T_{IU} + T_{processing} + T_{\Delta} + T_{margin}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

T_{IU} = 20 ms in the test. T_{IU} is defined in clause 6.1.1.2.2.

T_{Δ} = 20 ms in the test. T_{Δ} is defined in clause 6.1.1.2.2.

$T_{processing}$ = 40 ms in the test. $T_{processing}$ is defined in clause 6.1.1.2.2.

T_{margin} = 2 ms in the test. T_{margin} is defined in clause 6.1.1.2.2.

This gives a total of 792 ms.

The UE shall complete to release Cell 1 less than (10 ms + $T_{interrupt2}$) from the beginning of time period T4. During $D_{handover2}$, the interruption on Cell 2 shall not exceed $T_{interrupt2}$ as defined in Table 6.1.3.4.2-2 for asynchronous DAPS HO.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay $D_{handover2}$ can be expressed as: $T_{RRC\_procedure} + T_{interrupt2}$, where:

$T_{RRC\_procedure}$ = 10 ms and is specified in clause 12 in TS 38.331 [2].

A.7.3.2 RRC Connection Mobility Control

A.7.3.2.1 SA: RRC Re-establishment

A.7.3.2.1.1 Intra-frequency RRC Re-establishment in FR2

A.7.3.2.1.1.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR2 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.7.3.2.1.1.1-1, table A.7.3.2.1.1.1-2 and table A.7.3.2.1.1.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure.

Table A.7.3.2.1.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.1.1.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell1	
	Neighbour cells		1	Cell2	
Final condition	Active cell		1	Cell2	
RF Channel Number			1	1	
Time offset between cells			1	3 µs	Synchronous cells
N310		-	1	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1	0	Radio link failure timer; T310 is disabled
T311		ms	1	5000	RRC re-establishment timer
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
SMTC configuration			1	SMTC pattern 1	
DRX cycle length		s	1	OFF	
PRACH configuration			1	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1		s	1	5	
T2		ms	1	1600	Time for the UE to detect RLF
T3		s	1	3	

Table A.7.3.2.1.1.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
TDD configuration		1	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration		1	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1	TCI.State.2			N/A		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
AoA setup		1	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
$\hat{E}_s/I_{ot}$	dB	1	-3.07	-infinity	-infinity	-5.07	2	2
N_{oc} Note2	dBm/15 kHz	1	-98					
N_{oc} Note2	dBm/SCS	1	-89					
$\hat{E}_s/N_{oc}$	dB	1	4	-infinity	-infinity	2	2	2
SS-RSRP Note3	dBm/SCS	1	-85	-infinity	-infinity	-87	-87	-87
Io	dBm/95.04 MHz	1	-52.94	-55.89	-55.89	-52.94	-55.89	-55.89
Propagation Condition		1	AWGN					

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.2.1.1.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell shall be less than 3 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90%.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish\_delay} = T_{UL\_grant} + T_{UE\_re\text{-}establish\_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE\_re-establish\_delay} = 50 \text{ ms} + T_{identify\_intra\_NR} + \sum_{i=1}^{Nfreq-1} T_{identify\_inter\_NR,i} + T_{SI-NR} + T_{PRACH}$$

$N_{freq} = 1$

$T_{identify\_intra\_NR}$ = 1600 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 2945 ms, allow 3 s in the test case.

A.7.3.2.1.2 Inter-frequency RRC Re-establishment in FR2

A.7.3.2.1.2.1 Test Purpose and Environment

The purpose is to verify that the NR inter-frequency RRC re-establishment delay in FR2 without known target cell is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.7.3.2.1.2.1-1, table A.7.3.2.1.2.1-2 and table A.7.3.2.1.2.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, becomes inactive. The time period T3 starts after the occurrence of the radio link failure. During T1, the UE shall be configured with the carrier frequency of cell 2 (with RF Channel Number #2) to ensure that the UE has the context of the carrier frequency of cell 2 by the end of T1.

Table A.7.3.2.1.2.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.1.2.1-2: General test parameters for NR inter-frequency RRC Re-establishment test case in FR2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell1	
	Neighbour cells		1	Cell2	
Final condition	Active cell		1	Cell2	
RF Channel Number			1	1, 2	
Time offset between cells			1	3 μs	Synchronous cells
N310		-	1	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1	0	Radio link failure timer; T310 is disabled
T311		ms	1	5000	RRC re-establishment timer
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
			1	SMTC pattern 1	
DRX cycle length		s	1	OFF	
PRACH configuration			1	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1		s	1	5	
T2		ms	1	1600	Time for the UE to detect RLF
T3		s	1	6	

Table A.7.3.2.1.2.1-3: Cell specific test parameters for NR inter-frequency RRC Re-establishment test case in FR2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
AoA setup		1	Setup 3 as specified in clause A.3.15					
			AoA1			AoA2		
TDD configuration		1	TDDConf.3.1			TDDConf.3.1		
PDSCH RMC configuration		1	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1	CR.3.1 TDD			CR.3.1 TDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD			CCR.3.1 TDD		
TRS configuration		1	TRS.2.1 TDD			N/A		
PDSCH/PDCCH TCI state		1	TCI.State.2			N/A		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
$\hat{E}_s/I_{ot}$	dB	1	5	-infinity	-infinity	-infinity	-infinity	8
N_{oc} Note2	dBm/15 kHz	1	-98					
N_{oc} Note2	dBm/SCS	1	-89					
$\hat{E}_s/N_{oc}$	dB	1	5	-infinity	-infinity	-infinity	-infinity	8
SS-RSRP Note3	dBm/SCS	1	-84	-infinity	-infinity	-infinity	-infinity	-81
Io	dBm/95.04 MHz	1	-53.82	-infinity	-infinity	-infinity	-infinity	-51.37
Propagation Condition		1	AWGN					

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.2.1.2.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR inter frequency cell shall be less than 6 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90%.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish\_delay} = T_{UL\_grant} + T_{UE\_re\text{-}establish\_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE\_re-establish\_delay} = 50 \text{ ms} + T_{identify\_intra\_NR} + \sum_{i=1}^{Nfreq-1} T_{identify\_inter\_NR,i} + T_{SI-NR} + T_{PRACH}$$

N_{freq} = 2

$T_{identify\_intra\_NR}$ = 1600 ms

$T_{identify\_inter\_NR}$ = 2080 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target inter-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 5025 ms, allow 6 s in the test case.

A.7.3.2.1.3 Intra-frequency RRC Re-establishment in FR2 without serving cell timing

A.7.3.2.1.3.1 Test Purpose and Environment

The purpose is to verify that the NR intra-frequency RRC re-establishment delay in FR2 without serving cell timing is within the specified limits. These tests will verify the requirements in clause 6.2.1.

The test parameters are given in table A.7.3.2.1.3.1-1, table A.7.3.2.1.3.1-2 and table A.7.3.2.1.3.1-3 below. The test consists of 3 successive time periods, with time duration of T1, T2 and T3 respectively. At the start of time period T2, cell 1, which is the active cell, is deactivated. The time period T3 starts after the occurrence of the radio link failure.

Table A.7.3.2.1.3.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.1.3.1-2: General test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1	Cell1	
	Neighbour cells		1	Cell2	
Final condition	Active cell		1	Cell2	
RF Channel Number			1	1	
Time offset between cells			1	3 μs	Synchronous cells
N310		-	1	1	Maximum consecutive out-of-sync indications from lower layers
N311		-	1	1	Minimum consecutive in-sync indications from lower layers
T310		ms	1	6000	Radio link failure timer configured by *RLF-TimersAndConstants*
T311		ms	1	5000	RRC re-establishment timer
Access Barring Information		-	1	Not Sent	No additional delays in random access procedure.
SSB configuration			1	SSB.1 FR2	
SMTC configuration			1	SMTC pattern 1	
DRX cycle length		s	1	OFF	
PRACH configuration			1	FR2 PRACH configuration 1	Table A.3.8.3.1-1
T1		s	1	5	
T2		s	1	6	Time for the UE to detect RLF
T3		s	1	5	

Table A.7.3.2.1.3.1-3: Cell specific test parameters for NR intra-frequency RRC Re-establishment test case in FR2

Parameter	Unit	Test configuration	Cell 1			Cell 2		
			T1	T2	T3	T1	T2	T3
Assumption for UE beams Note 4			Rough			Rough		
TDD configuration		1	TDDConf.3.1			TDDConf.3.1		
		1	SR.3.1 TDD			N/A		
RMSI CORESET RMC configuration		1	CR.3.1 FDD			CR.3.1 FDD		
Dedicated CORESET RMC configuration		1	CCR.3.1 FDD			CCR.3.1 FDD		
TRS configuration		1	TRS.2.1 TDD			N/A		
TCI state		1	CSI-RS.Config.0			N/A		
OCNG Pattern		1	OP.1 defined in A.3.2.1			OP.1 defined in A.3.2.1		
Initial DL BWP configuration		1	DLBWP.0.1			DLBWP.0.1		
Initial UL BWP configuration		1	ULBWP.0.1			ULBWP.0.1		
RLM-RS		1	SSB			SSB		
AoA setup		1	Setup 1 defined in A.3.15.1			Setup 1 defined in A.3.15.1		
$\hat{E}_s/I_{ot}$	dB	1	5	-infinity	-infinity	-infinity	-infinity	5
N_{oc} Note2	dBm/SCS	1	-98					
N_{oc} Note2	dBm/15 kHz	1	-89					
$\hat{E}_s/N_{oc}$	dB	1	5	-infinity	-infinity	-infinity	-infinity	5
SS-RSRP Note3	dBm/SCS	1	-93	-infinity	-infinity	-infinity	-infinity	-93
Io	dBm/95.04 MHz	1	-62.82	-infinity	-infinity	-infinity	-infinity	-62.82
Propagation Condition		1	AWGN					
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation								

A.7.3.2.1.3.2 Test Requirements

The RRC re-establishment delay is defined as the time from the start of time period T3, to the moment when the UE starts to send PRACH preambles to cell 2 for sending the *RRCReestablishmentRequest* message to cell 2.

The RRC re-establishment delay to an unknown NR intra frequency cell without serving cell timing shall be less than 5 s.

The rate of correct RRC re-establishments observed during repeated tests shall be at least 90%.

NOTE: The RRC re-establishment delay in the test is derived from the following expression:

$$T_{re\text{-}establish\_delay} = T_{UL\_grant} + T_{UE\_re\text{-}establish\_delay}.$$

Where:

T_{UL_grant} = It is the time required to acquire and process uplink grant from the target cell. The PRACH reception at the system simulator is used as a trigger for the completion of the test; hence T_{UL_grant} is not used.

$$T_{UE\_re-establish\_delay} = 50 \text{ ms} + T_{identify\_intra\_NR} + \sum_{i=1}^{Nfreq-1} T_{identify\_inter\_NR,i} + T_{SI-NR} + T_{PRACH}$$

N_{freq} = 1

$T_{identify\_intra\_NR}$ = 3520 ms

T_{SI} = 1280 ms; it is the time required for receiving all the relevant system information as defined in TS 38.331 [2] for the target intra-frequency NR cell.

T_{PRACH} = 15 ms; it is the additional delay caused by the random access procedure.

This gives a total of 4865 ms, allow 5 s in the test case.

A.7.3.2.2 Random Access

A.7.3.2.2.1 Contention based random access test in FR2 for NR Standalone

A.7.3.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in Table A.7.3.2.2.1.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in Table A.7.3.2.2.1.1-2 and Table A.7.3.2.2.1.1-3.

Table A.7.3.2.2.1.1-1: Supported test configurations for contention based random access test in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.2.1.1-2: General test parameters for contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 FR2	As defined in A.3.10
Duplex Mode for Cell 1	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	As defined in A.3.1.4
$BW_{channel}$	Config 1	MHz	100: $N_{RB,c}$ = 24	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	As defined in A.3.1.2
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
PRACH Configuration			FR2 PRACH configuration 1	As defined in A.3.8.3, with exceptions as defined below
rsrp-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

Note 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6dBm/SCS applied, *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.

Note 4: The Δ_{DL} value is calculated as (RSRP_$_{REP}$ – RSRP_76), where RSRP_$_{REP}$ is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.7.3.2.2.1.1-3: OTA-related test parameters for contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 3			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	AWGN	
Note 1: No articial noise is applied in this test. Note 2: Void. Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.3.2.2.1.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.7.3.2.2.1.2.1 Random Access Preamble Transmission

To test the UE behavior specified in Clause 6.2.2.2.1.1 the System Simulator shall receive the Random Access Preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *rsrp-ThresholdSSB.*

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.1.2.2 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.1.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.1.2.3 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.1.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.1.2.4 Receiving an UL grant for msg3 retransmission

To test the UE behavior specified in clause 6.2.2.2.1.4 the System Simulator shall provide an UL grant for msg3 retransmission following a successful Random Access Response.

The UE shall re-transmit the msg3 upon the reception of an UL grant for msg3 retransmission.

A.7.3.2.2.1.2.5 Reception of an Incorrect Message over Temporary C-RNTI

To test the UE behavior specified in Clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element *not* matching the CCCH SDU transmitted in msg3 uplink message.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

A.7.3.2.2.1.2.6 Reception of a Correct Message over Temporary C-RNTI

To test the UE behavior specified in Clause 6.2.2.2.1.5 the System Simulator shall send a message addressed to the temporary C-RNTI with a UE Contention Resolution Identity included in the MAC control element matching the CCCH SDU transmitted in the msg3 uplink message.

The UE shall send ACK if the Contention Resolution is successful.

A.7.3.2.2.1.2.7 Contention Resolution Timer expiry

To test the UE behavior specified in Clause 6.2.2.2.1.6 the System Simulator shall *not* send a response to a msg3.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

A.7.3.2.2.2 Non-contention based random access test in FR2 for NR Standalone

A.7.3.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.2 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in Table A.7.3.2.2.2.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in Table A.7.3.2.2.2.1-2 and Table A.7.3.2.2.2.1-3 for SSB-based non-contention based random access test (Test 1) and CSI-RS-based non-contention based random access test (Test 2). Test 2 is only applicable to UE which supports csi-RSRP-AndRSRQ-MeasWithSSB or csi-RSRP-AndRSRQ-MeasWithoutSSB.

Table A.7.3.2.2.2.1-1: Supported test configurations for non-contention based random access test in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.2.2.1-2: General test parameters for non-contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Test-2	Comments
SSB Configuration	Config 1		SSB.1 FR2	SSB.1 FR2	As defined in A.3.10
CSI-RS Configuration	Config 1		N/A	CSI-RS.3.1 TDD	As defined in A.3.1.4
Duplex Mode for Cell 2	Config 1		TDD	TDD	
TDD Configuration	Config 1		TDDConf.3.1	TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{RB,c}$ = 24	100: $N_{RB,c}$ = 24	
OCNG Pattern Note 1			OP.3	OP.3	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR3.1 TDD	SR3.1 TDD	As defined in A.3.1.1.
NR RF Channel Number			1	1	
EPRE ratio of PSS to SSS		dB	0	0	
EPRE ratio of PBCH_DMRS to SSS		dB			
EPRE ratio of PBCH to PBCH_DMRS		dB			
EPRE ratio of PDCCH_DMRS to SSS		dB			
EPRE ratio of PDCCH to PDCCH_DMRS		dB			
EPRE ratio of PDSCH_DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH_DMRS		dB			
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,f,c}$)		dBm	maximum value configurable for certain power class	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
PRACH Configuration			FR2 PRACH configuration 1	FR2 PRACH configuration 1	As defined in A.3.8.3, with exceptions as defined below.
rsrp-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	-100	As defined in TS 38.331 [2]

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

Note 3: The Δ_{UL} value is calculated as -ROUND(P_{PRACH0} -1), where P_{PRACH0} is the measured first PRACH power with -80.6dBm/SCS applied, *preambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send PRACH.

Note 4: The Δ_{DL} value is calculated as (RSRP_REP – RSRP_76), where RSRP_REP is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.7.3.2.2.2.1-3: OTA-related test parameters for non-contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Test-2	Comments
AoA setup			Setup 1	Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 3			Rough	Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	-80.6	Power of SSB with index 0 is set to be above configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	-80.6	
	Es/Iot_{BB}	dB	21.09	21.09	
	Io	dBm/95.04 MHz	-56.01	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	-95.0	Power of SSB with index 1 is set to be below configured *rsrp-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	-95.0	
	Es/Iot_{BB}	dB	6.69	6.69	
	Io	dBm/95.04 MHz	-70.41	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	AWGN	AWGN	
Note 1: No articial noise is applied in this test. Note 2: void. Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.3.2.2.2.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.7.3.2.2.2.2.1 SSB-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.2.2.1 for SSB-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-ssb-OccasionMaskIndex*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.2.2.2 CSI-RS-based Random Access Preamble Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.2.2.1 for CSI-RS-based Random Access Preamble tranmsision, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with CSI-RSs configured, the System Simulator shall receive the Random Access Preamble which has the Preamble Index associated with the CSI-RS configured.

In addition, the System Simulator shall receive the Random Access Preamble on the PRACH occasion which belongs to the PRACH occasions corresponding to the CSI-RS configured, and the selected PRACH occasion shall belongs to the PRACH occassions permitted by the restrictions given by the *ra-OccasionList*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.2.2.3 Random Access Response Reception

To test the UE behavior specified in Clause 6.2.2.2.2.2 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a Random Access Response *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for Random Access Response(s) if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.2.2.4 No Random Access Response Reception

To test the UE behavior specified in clause 6.2.2.2.2.3 the System Simulator shall transmit a Random Access Response containing a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2 in TS 38.321 [7], and transmit with the calculated PRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window configured in *RACH-ConfigCommon*.

In addition, the power applied to all preambles shall be in accordance with what is specified in Clause 6.2.2.2. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The relative power applied to additional preambles shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all PRACH transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.3 2-step RA type contention based random access test in FR2 for NR Standalone

A.7.3.2.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the 2-step RA type random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.3 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in Table A.7.3.2.2.3.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in Table A.7.3.2.2.3.1-2 and Table A.7.3.2.2.3.1-3.

Table A.7.3.2.2.3.1-1: Supported test configurations for 2-step RA type contention based random access test in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.2.3.1-2: General test parameters for 2-step RA type contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 FR2	As defined in A.3.10
Duplex Mode for Cell 1	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	As defined in A.3.1.4
$BW_{channel}$	Config 1	MHz	100: $N_{RB,c}$ = 24	
OCNG Pattern Note 1			OCNG pattern 1	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR.3.1 TDD	As defined in A.3.1.1.
RMSI CORESET Reference Channel	Config 1		CR.3.1 TDD	As defined in A.3.1.2
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,\ f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration			FR2 MsgA configuration 1	As defined in A.3.20.3, with exceptions as defined below
msgA-RSRP-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process Note 4
preambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

Note 3: The Δ_{UL} value is calculated as -ROUND(PMsgA0 -1), where PMsgA0 is the measured first MsgA PRACH power with -80.6dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA.

Note 4: The Δ_{DL} value is calculated as ($RSRP\_{REP}$ – RSRP_76), where $RSRP\_{REP}$ is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.7.3.2.2.3.1-3: OTA-related test parameters for 2-step RA type contention based random access test in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
AoA setup			Setup 2b	As defined in A.3.15.1
Assumption for UE beams Note 2			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	AWGN	
Note 1: No articial noise is applied in this test. Note 2: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.3.2.2.3.2 Test Requirements

Contention based random access is triggered by *not* explicitly assigning a random access preamble via dedicated signalling in the downlink.

A.7.3.2.2.3.2.1 MsgA Transmission

To test the UE behavior specified in Clause 6.2.2.3.1.1 the System Simulator shall receive the MsgA with a preamble which belongs to one of the Random Access Preambles associated with the SSB with index 0, which has SS-RSRP above the configured *msgA-RSRP-ThresholdSSB.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.3.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.1.2 the System Simulator shall transmit a MsgB containing a fallbackRAR message and a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB(s) and shall transmit the msg3 if the MsgB with a fallbackRAR contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit MsgA with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if all received MsgB's contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA PRACH shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.3.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.1.3 the System Simulator shall transmit a MsgB containing a fallbackRAR message and Random Access Preamble identifier corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA PRACH and MsgA PUSCH transmission power when the backoff time expires if no MsgB is received within the MsgB Response window.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first MsgA PRACH shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.4 Non-contention based random access test for 2-step RA type in FR2 for NR Standalone

A.7.3.2.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the behavior of the random access procedure is according to the requirements and that the PRACH power settings and timing are within specified limits. This test will verify the requirements in Clause 6.2.2.3 and Clause 7.1.2 in an AWGN model.

For this test one cell is used, with the configuration of Cell 1 configured as PCell or SCell in FR2. Supported test parameters are shown in Table A.7.3.2.2.4.1-1. UE capable of SA with PCell or SCell in FR2 needs to be tested by using the parameters in Table A.7.3.2.2.4.1-2 and Table A.7.3.2.2.4.1-3.

Table A.7.3.2.2.4.1-1: Supported test configurations for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

Config	Description
1	NR PSCell/SCell 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.2.4.1-2: General test parameters for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
SSB Configuration	Config 1		SSB.1 FR2	As defined in A.3.10
Duplex Mode for Cell 2	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
$BW_{channel}$	Config 1	MHz	100: $N_{RB,c}$ = 24	
OCNG Pattern Note 1			OP.3	As defined in A.3.2.1.
PDSCH Reference Channel Note 2	Config 1		SR3.1 TDD	As defined in A.3.1.1.
NR RF Channel Number			1	
EPRE ratio of PSS to SSS		dB	0	
EPRE ratio of PBCH_DMRS to SSS		dB		
EPRE ratio of PBCH to PBCH_DMRS		dB		
EPRE ratio of PDCCH_DMRS to SSS		dB		
EPRE ratio of PDCCH to PDCCH_DMRS		dB		
EPRE ratio of PDSCH_DMRS to SSS		dB		
EPRE ratio of PDSCH to PDSCH_DMRS		dB		
ss-PBCH-BlockPower		dBm/ SCS	+20 +Δ_{UL}	As defined in TS 38.331 [2]. Δ_{UL} is derived from the uplink calibration process Note 3
Configured UE transmitted power ($P_{CMAX,f,c}$)		dBm	maximum value configurable for certain power class	As defined in clause 6.2.4 in TS 38.101-2 [19]
MsgA Configuration			FR2 MsgA configuration 2	As defined in A.3.20.3, with exceptions as defined below.
msgA-RSRP-ThresholdSSB		dBm	RSRP_69 +Δ_{DL}	RSRP_69 corresponds to -88dBm. Δ_{DL} is derived from the downlink calibration process Note 4
msgA-PreambleReceivedTargetPower		dBm	-100	As defined in TS 38.331 [2]

Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. The OCNG pattern is chosen during the test according to the presence of a DL reference measurement channel.

Note 2: The DL PDSCH reference measurement channel is used in the test only when a downlink transmission dedicated to the UE under test is required.

Note 3: The Δ_{UL} value is calculated as -ROUND(P_{MsgA0} -1), where P_{MsgA0} is the measured first MsgA PRACH power with -80.6dBm/SCS applied, *msgA-PreambleReceivedTargetPower* = -100dBm and *ss-PBCH-BlockPower* = 20dBm. These values are used during the uplink calibration process carried out before the test case is run, with the UE configured to send MsgA.

Note 4: The Δ_{DL} value is calculated as (RSRP_$_{REP}$ – RSRP_76), where RSRP_$_{REP}$ is the SS-RSRP Reported value in Table 10.1.6.1-1 with -80.6dBm/SCS applied. These values are used during the downlink calibration process carried out before the test case is run, with the UE configured to report SS-RSRP. For a Reported value RSRP_x, x is treated as a positive integer value.

Table A.7.3.2.2.4.1-3: OTA-related test parameters for non-contention based random access test for 2-step RA type in FR2 for NR Standalone

Parameter		Unit	Test-1	Comments
AoA setup			Setup 1	As defined in A.3.15.1
Assumption for UE beams Note 2			Rough	
SSB with index 0	Es Note1	dBm/SCS	-80.6	Power of SSB with index 0 is set to be above configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-80.6	
	Es/Iot_{BB}	dB	21.09	
	Io	dBm/95.04 MHz	-56.01	Io in symbols containing SSB index 0
SSB with index 1	Es Note1	dBm/SCS	-95.0	Power of SSB with index 1 is set to be below configured *msgA-RSRP-ThresholdSSB*
	SSB_RP	dBm/SCS	-95.0	
	Es/Iot_{BB}	dB	6.69	
	Io	dBm/95.04 MHz	-70.41	Io in symbols containing SSB index 1
Propagation Condition		-	AWGN	
Note 1: No artificial noise is applied in this test. Note 2: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.3.2.2.4.2 Test Requirements

Non-Contention based random access is triggered by explicitly assigning a random access preamble via dedicated signalling in the downlink. In the test, the non-contention based random access procedure is not initialized for Other SI requested from UE or beam failure recovery.

A.7.3.2.2.4.2.1 MsgA Transmission

In Test-1, to test the UE behavior specified in Clause 6.2.2.3.2.1 for MsgA transmission, with the contention-free Random Access Resources and the contention-free PRACH occasions associated with SSBs configured, the System Simulator shall receive the MsgA which has the Preamble Index associated with the SSB with index 0.

In addition, the System Simulator shall receive the MsgA on the PRACH occasion which belongs to the PRACH occasions corresponding to the SSB with index 0, and the selected PRACH occasion shall belongs to the PRACH occasions permitted by the restrictions given first by the *msgA-SSB-SharedRO-MaskIndex* if configured, or next by the *ra-ssb-OccasionMaskIndex* if configured.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.4.2.2 MsgB Reception

To test the UE behavior specified in Clause 6.2.2.3.2.2 the System Simulator shall transmit a MsgB containing a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble after 3 MsgA transmissions have been received by the System Simulator. In response to the first 2 preambles, the System Simulator shall transmit a MsgB *not* corresponding to the transmitted Random Access Preamble.

The UE may stop monitoring for MsgB if the MsgB contains a successRAR MAC subPDU corresponding to the transmitted Random Access Preamble.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power if all received Random Access Response Reception has not been considered as successful.

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.2.4.2.3 No MsgB Reception

To test the UE behavior specified in clause 6.2.2.3.2.3 the System Simulator shall transmit a MsgB corresponding to the transmitted Random Access Preamble after 3 preambles have been received by the System Simulator. The System Simulator shall *not* respond to the first 2 preambles.

The UE shall again perform the Random Access Resource selection procedure specified in clause 5.1.2a in TS 38.321 [7], and transmit with the calculated MsgA transmission power when the backoff time expires if no MsgB is received within the MsgB Response window configured in *RACH-ConfigGenericTwoStepRA.*

In addition, the power applied to all MsgA transmissions shall be in accordance with what is specified in Clause 6.2.2.3. The power of the first preamble shall be 0.6 dBm to be received at TE with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19]. The power of the first MsgA PUSCH transmission shall be $0.6 + 3(\mu + 2)$ dBm with an accuracy specified in clause 6.3.4.2 of TS 38.101-2 [19], where μ indicates the MsgA PUSCH numerology. The relative power applied to additional MsgA transmissions shall have an accuracy specified in clause 6.3.4.3 of TS 38.101-2 [19].

The transmit timing of all MsgA transmissions shall be within the accuracy specified in Clause 7.1.2.

A.7.3.2.3 SA: RRC Connection Release with Redirection

A.7.3.2.3.1 Redirection from NR in FR2 to NR in FR2

A.7.3.2.3.1.1 Test Purpose and Environment

This test is to verify RRC connection release with redirection from NR to NR requirements specified in clause 6.2.3.2.1.

A.7.3.2.3.1.2 Test Parameters

Supported test configurations are shown in table A.7.3.2.3.1.2-1. The time delay is tested by using the parameters in table A.7.3.2.3.1.2-2, and A.7.3.2.3.1.2-3.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. The *RRCRelease* message shall be sent to the UE during period T1 and the start of T2 is the instant when the last TTI containing the RRC message is sent to the UE. Prior to time duration T2, the UE shall not have any timing information of Cell 2. Cell 2 is powered up at the beginning of the T2.

Table A.7.3.2.3.1.2-1: Redirection from NR to NR test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.2.3.1.2-2: General test parameters for Redirection from NR to NR test case

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	3.2	

Table A.7.3.2.3.1.2-3: Cell specific test parameters for Redirection from NR to NR test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
Assumption for UE beams[Note 6]			Rough		Rough	
AoA setup			Setup TBD as defined in A.3.15			
NR RF Channel Number			1		2	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{RB,c}$ = 66			
BWP BW		MHz	100: $N_{RB,c}$ = 66			
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
CORESET Reference Channel			CR3.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC configuration			SMTC.1 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
TCI configuration			CSI-RS.Config.0			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-104.7		-104.7	
N_{oc} Note2	Config 1,2	dBm/SCS	-95.7		-95.7	
	Config 3		-95.7		-95.7	
$\hat{E}_s/I_{ot}$		dB	5	5	-Infinity	5
$\hat{E}_s/N_{oc}$		dB	5	5	-Infinity	5
Io[Note3]	Config 1,2	dBm/ BW	-60.5	-60.5	-66.7	-60.5
	Config 3	dBm/ BW	-60.5	-60.5	-66.7	-60.5
Propagation condition		-	AWGN			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.3.2.3.1.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 3160 ms from the beginning of time period T2.

The rate of correct RRC connection release redirection to NR observed during repeated tests shall be at least 90%.

NOTE: The redirection delay can be expressed as:

$$T_{connection\_release\_redirect\_NR} = T_{RRC\_procedure\_delay} + T_{identify\text{-}NR} + T_{SI\text{-}NR} + T_{RACH},$$

where:

$T_{RRC\_procedure\_delay}$ = 110 ms in the test.

$T_{identify\text{-}NR}$ = 1760 ms in the test.

$T_{SI\text{-}NR}$ = 1280 ms, it is the time required for receiving all the relevant system information as defined in TS 38.331 for the target NR cell.

T_{RACH} = 10 ms in the test.

This gives a total of 3160 ms.

A.7.3.3 Conditional Handover

A.7.3.3.1 Intra-frequency conditional handover from FR2 to FR2

A.7.3.3.1.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 intra frequency conditional handover requirements specified in clause 6.1.4.4.

A.7.3.3.1.2 Test Parameters

Supported test configurations are shown in table A.7.3.3.2.2-1. Both handover delay and interruption length are tested by using the parameters in table A.7.3.3.2.2-2, and A.7.3.3.2.2-3.

The test scenario comprises of two cells. No gap patterns are configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. At the start of time duration T1, the UE does not have any timing information of cell 2. NR shall configure a condition implying handover to cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2. Starting T2, cell 2 becomes detectable.

Table A.7.3.3.1.2-1: Intra-frequency conditional handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.3.1.2-2: General test parameters for conditional Intra-frequency handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A3-Offset for condition		dBm	-1	Trigger HO to cell which may be measured as -1dB relative to cell 1. Actual SS-RSRP is 5dB stronger.
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤2	

Table A.7.3.3.1.2-3: Cell specific test parameters for NR FR2-FR2 conditional Intra frequency handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		1	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{RB,c}$ = 66			
BWP BW		MHz	100: $N_{RB,c}$ = 66			
DRx Cycle		ms	Not Applicable			
PDSCH Reference measurement channel			SR3.1 TDD			
CORESET Reference Channel			CR3.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB.1 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
TCI configuration			CSI-RS.Config.0			
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-104.7		-104.7	
N_{oc} Note2	Config 1	dBm/SCS	-98.7		-98.7	
$\hat{E}_s/I_{ot}$		dB	6	-5.33	-Infinity	4.02
$\hat{E}_s/N_{oc}$		dB	6	6	-Infinity	11
Io Note3	Config 1	dBm/BW	-62.7	-57.2	-62.7	-57.2
Propagation condition		-	AWGN			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

A.7.3.3.1.2.3 Test Requirements

T_{RRC} + T_{Event_DU} occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{interrupt}$ + $T_{CHO\_execution}$ =1600+62+10=1672 ms (power class 1) or 1080+62+10 =1152 (PC2/3/4) 62 ms=1152 ms (power classes 2,3 and 4) from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}$=$T_{processing}$ + T_{IU} + T_{Δ} + T_{margin} =40+20+2 = 62ms excluding any transmissions which do not occur due to scheduling restrictions.

A.7.3.3.2 Inter-frequency handover from FR2 to FR2; unknown target cell

A.7.3.3.2.1 Test Purpose and Environment

This test is to verify the requirement for the NR FR2-NR FR2 inter frequency conditional handover requirements specified in clause 6.1.4.4.

A.7.3.3.2.2 Test Parameters

Supported test configurations are shown in table A.7.3.3.3.2-1. Both conditional handover delay and interruption length are tested by using the parameters in table A.7.3.3.3.2-2, and A.7.3.3.3.2-3.

The test scenario comprises of two carriers and one cell on each carrier. Gap pattern ID gp0 is configured in the test case. The test consists of two successive time periods, with time durations of T1, T2 respectively. . At the start of time duration T1, the UE does not have any timing information of cell 2. NR shall configure a condition implying handover to cell 2 during T1, at a time earlier than T_{RRC} before the beginning of T2. At the start of T2, cell 2 becomes detectable and meets the handover condition.

Table A.7.3.3.2.2-1: Inter-frequency conditional handover from FR2 to FR2 test configurations

Config	Description
1	Source cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode Target cell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.3.3.2.2-2: General test parameters Inter-frequency conditional handover from FR2 to FR2

Parameter		Unit	Value	Comment
Initial conditions	Active cell		Cell 1	
	Neighbouring cell		Cell 2	
Final condition	Active cell		Cell 2	
A4-Offset for handover condition		dB	-120	
Hysteresis		dB	0	
Time To Trigger		s	0	
Filter coefficient			0	L3 filtering is not used
Access Barring Information		-	Not Sent	No additional delays in random access procedure.
Time offset between cells			3 μs	Synchronous cells
T1		s	5	
T2		s	≤7	

Table A.7.3.3.2.2-3: Cell specific test parameters for NR FR2-FR2 Inter frequency conditional handover test case

Parameter		Unit	Cell 1		Cell 2	
			T1	T2	T1	T2
NR RF Channel Number			1		2	
Duplex mode			TDD			
TDD configuration			TDDConf.3.1			
$BW_{channel}$		MHz	100: $N_{RB,c}$ = 66			
BWP BW		MHz	100: $N_{RB,c}$ = 66			
DRx Cycle		ms	Not Applicable			
Gap pattern ID			gp0			
PDSCH Reference measurement channel			SR3.1 TDD			
CORESET Reference Channel			CR3.1 TDD			
OCNG Patterns			OCNG pattern 1			
SMTC Configuration			SMTC pattern 1			
SSB Configuration			SSB.1 FR2			
PDSCH/PDCCH subcarrier spacing		kHz	120 kHz			
PUCCH/PUSCH subcarrier spacing		kHz	120 kHz			
PRACH configuration			FR2 PRACH configuration 1			
TRS configuration			TRS.2.1 TDD			
TCI configuration			CSI-RS.Config.0			
BWP configuraiton	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
EPRE ratio of PSS to SSS		dB	0		0	
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH						
EPRE ratio of OCNG DMRS to SSS(Note 1)						
EPRE ratio of OCNG to OCNG DMRS (Note 1)						
N_{oc} Note2		dBm/15kHz	-104.7		-104.7	
N_{oc} Note2	Config 1,2	dBm/SCS	-95.7		-95.7	
	Config 3		-95.7		-95.7	
$\hat{E}_s/I_{ot}$		dB	5	5	-Infinity	5
$\hat{E}_s/N_{oc}$		dB	5	5	-Infinity	5
Io Note3	Config 1,2	dBm/BW	-60.5	-60.5	-66.7	-60.5
	Config 3	dBm/BW	-60.5	-60.5	-66.7	-60.5
Propagation condition		-	AWGN			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone

A.7.3.3.2.3 Test Requirements

T_{RRC} + T_{Event_DU} occurs during T1 as the handover condition becomes satisfied at the start of T2. The test shall verify that there are no interruptions during T1.

The UE shall start to transmit the PRACH to Cell 2 less than $T_{measure}$ + $T_{interrupt}$ + $T_{CHO\_execution}$ = 6720+62+10ms=6792 ms (power class 1) or 4160+62+10ms =4232ms (power classes 2,3 and 4) from the start of T2 and the interruption during T2 shall not exceeed $T_{interrupt}$=$T_{processing}$ + T_{IU} + T_{Δ} + T_{margin} =40+20+2 = 62ms excluding any transmissions which do not occur due to scheduling restrictions. excluding any transmissions which do not occur due to scheduling restrictions.

A.7.4 Timing

A.7.4.1 UE transmit timing

A.7.4.1.1 NR UE Transmit Timing Test for FR2

A.7.4.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the connected gNodeb and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1.2.

Supported test configurations are shown in Table 7.4.1.1.1-1.

Table A.7.4.1.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	NR TDD, SSB SCS 240 kHz, data SCS 120 kHz, BW 100 MHz

For this test a single NR cell is used. Tables A.7.4.1.1.1-2 and A.7.4.1.1.1-2A define the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.7.4.1.1.1-3.

Table A.7.4.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

Parameter	Unit	Config	Test1	Test2
SSB ARFCN		1	Freq1	Freq1
TDD configuration		1	TDDConf.3.1	
$BW_{channel}$	MHz	1	100: $N_{RB,c}$ = 66	
Initial BWP Configuration		1	DLBWP.0.1 ULBWP.0.1	
Dedicated BWP Configuration		1	DLBWP.1.1 ULBWP.1.1	
TRS Configuration		1	TRS.2.1 TDD	
TCI State		1	CSI-RS.Config.0	
DRx Cycle	ms	1	N/A	DRX.8[Note5]
PDSCH Reference measurement channel		1	SR.3.1 TDD	
RMSI CORESET Reference Channel		1	CR.3.1 TDD	
Dedicated CORESET Reference Channel		1	CCR.3.1 TDD	
OCNG Patterns		1	OP.1	
SSB Configuration		1	SSB.4 FR2	
SMTC Configuration		1	SMTC.1	
EPRE ratio of PSS to SSS	dB	1	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation condition		1	AWGN	
SRS Config		1	SRSConf.1[Note6]	SRSConf.2[Note6]

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: DRx related parameters are given in Table A.3.3.8-1
Note 6: SRS configs are given in Table A.7.4.1.1.1-3

Table A.7.4.1.1.1-2A: OTA related test parameters

Parameter	Unit	Test 1	Test 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 6		Fine	
N_{oc} Note1	dBm/15kHz Note4	-112	
N_{oc} Note1	dBm/SCS Note3	-103	
$\hat{E}_s/N_{oc}$	dB	4	
SS-RSRP Note2	dBm/SCS Note4	-99	
$\hat{E}_s/I_{ot}$	dB	4	
Io Note2	dBm/95.04 MHz Note4	-68.5	
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

Table A.7.4.1.1.1-3: SRS Configuration for Timing Accuracy Test

	Field	SRSConf.1	SRSConf.2	Comments
SRS-ResourceSet	srs-ResourceSetId	0	0	
	srs-ResourceIdList	0	0	
	resourceType	Periodic	Periodic	
	Usage	Codebook	Codebook	
SRS-Resource	SRS-ResourceId	0	0	
	nrofSRS-Ports	Port1	Port1	
	transmissionComb	n2	n2	
	combOffset-n2	0	0	
	cyclicShift-n2	0	0	
	resourceMapping startPosition	0	0	
	resourceMapping nrofSymbols	n1	n1	
	resourceMapping repetitionFactor	n1	n1	
	freqDomainPosition	0	0	
	freqDomainShift	0	0	
	freqHopping c-SRS	17	17	Matches $N_{RB,c}$
	freqHopping b-SRS	0	0	
	freqHopping b-hop	0	0	
	groupOrSequenceHopping	Neither	Neither	
	resourceType	Periodic	Periodic	
	periodicityAndOffset-p	sl1, 0	sl2560, 4	Offset to align with DRx periodicity
	sequenceId	0	0	Any 10 bit number

Table A.7.4.1.1.1-4: Void

A.7.4.1.1.2 Test requirements

The test sequence shall be carried out in RRC_CONNECTED for every test case.

Following will be the test sequence for this test:

1) Setup NR PCell according to parameters given in Table A.7.4.1.1.1-1.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within $(N_{TA} + N_{TA\_offset}) \times T_c \pm T_e$ of the first detected path of DL SSB.

   a. The N_{TA} offset value (in T_c units) is 13792

   b. The T_e values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1.2-1

3) The test system shall adjust the timing of the DL path by values given in Table A.7.4.1.1.2-1

Table A.7.4.1.1.2-1 Adjustment Value for DL Timing

SCS of SSB signals (kHz)	Adjustment Value	
	Test1	Test2
240	+8*64T_c	+4*64T_c

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in clause 7.1.2 Table 7.1.2.1-1 until the UE transmit timing offset is within (N_{TA} + N_{TA_offset}) ×T_c ± T_e respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX confiured.

5) The test system shall verify that the UE transmit timing offset stays within (N_{TA} + N_{TA_offset}) ×T_c ± T_e of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

A.7.4.2 UE timer accuracy

A.7.4.3 Timing advance

A.7.4.3.1 SA FR2 timing advance adjustment accuracy

A.7.4.3.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3.

A.7.4.3.1.2 Test Parameters

Supported test configurations are shown in table A.7.4.3.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.7.4.3.1.2-2, A.7.4.3.1.2-3 and A.7.4.3.1.2-4.

In all test cases, single cell is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.7.4.3.1.2-3, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.7.4.3.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3.2.1, the UE adjusts its uplink timing at slot n+k for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.7.4.3.1.2-1: Timing advance supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.4.3.1.2-2: General test parameters for timing advance

Parameter	Unit	Value	Comment
RF channel number		1	
Initial DL BWP		DLBWP.0.1	As specified in Table A.3.9.2.1-1
Dedicated DL BWP		DLBWP.1.1	As specified in Table A.3.9.2.2-1
Initial UL BWP		ULBWP.0.1	As specified in Table A.3.9.3.1-1
Dedicated UL BWP		ULBWP.1.1	As specified in Table A.3.9.3.2-1
Timing Advance Command (T_A) value during T1		31	$N_{TA\_new} = N_{TA\_old}$ for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2
Timing Advance Command (T_A) value during T2		39	*For 120 kHz SCS* $N_{TA\_new} = N_{TA\_old} + 1024*T_c$ (based on equation in clause 4.2 of TS 38.213 [3])
T1	s	5	
T2	s	5	

Table A.7.4.3.1.2-3: Cell specific test parameters for timing advance

Parameter	Unit	Test1	
		T1	T2
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	
BWP BW	MHz	100: $N_{RB,c}$ = 66	
DRx Cycle	ms	Not Applicable	
PDSCH Reference measurement channel		SR.3.1 TDD	
CORESET Reference Channel		CR.3.1 TDD	
OCNG Patterns		OCNG pattern 1	
TRS configuration		TRS.2.1 TDD	
TCI configuration		CSI-RS.Config.0	
SMTC configuration		SMTC.1 FR2	
SSB Configuration		SSB.3 FR2	
PDSCH/PDCCH subcarrier spacing	kHz	120 kHz	
PUCCH/PUSCH subcarrier spacing	kHz	120 kHz	
EPRE ratio of PSS to SSS	dB	0	
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation condition	-	AWGN	
Note 1: OCNG shall be used such that the resources in the cell in this test are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone			

Table A.7.4.3.1.2-3A: OTA related test parameters

Parameter	Unit	Test 1	
		T1	T2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 6		Fine	
N_{oc} Note1	dBm/15kHz Note4	-112	
N_{oc} Note1	dBm/SCS Note3	-103	
$\hat{E}_s/N_{oc}$	dB	4	
SS-RSRP Note2	dBm/SCS Note4	-99	
$\hat{E}_s/I_{ot}$	dB	4	
Io Note2	dBm/95.04 MHz Note4	-68.5	
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone Note 6: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation			

Table A.7.4.3.1.2-4: Sounding Reference Symbol Configuration for timing advance

Field	Value	Comment
c-SRS	16	Frequency hopping is disabled
b-SRS	0	
b-hop	0	
freqDomainPosition	0	Frequency domain position of SRS
freqDomainShift	0	
groupOrSequenceHopping	neither	No group or sequence hopping
SRS-PeriodicityAndOffset	sl5=0	Once every 5 slots
pathlossReferenceRS	ssb-Index=0	SSB #0 is used for SRS path loss estimation
usage	Codebook	Codebook based UL transmission
startPosition	0	resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition.
nrofSymbols	n1	
repetitionFactor	n1	
combOffset-n2	0	transmissionComb setting
cyclicShift-n2	0	
nrofSRS-Ports	port1	Number of antenna ports used for SRS transmission
Note: For further information see clause 6.3.2 in TS 38.331 [2].		

A.7.4.3.1.3 Test Requirements

The UE shall apply the signalled Timing Advance value to the transmission timing at the designated activation time i.e. $k+1$ slots after the reception of the timing advance command, where k = 11.

The Timing Advance adjustment accuracy shall be within the limits specified in clause 7.3.2.2.

The rate of correct Timing Advance adjustments observed during repeated tests shall be at least 90%.

A.7.5 Signaling characteristics

A.7.5.1 Radio link Monitoring

In the following clause, any uplink signal transmitted by the UE is used for detecting the In-/Out-of-Sync state of the UE. In terms of measurement, the uplink signal is verified on the basis of the UE output power:

Editor note: The metric for the detection of the UE UL transmitted signal by the TE is FFS.

A.7.5.1.1 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode

A.7.5.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.1.1-1. The test parameters are given in Tables A.7.5.1.1.1-2, A.7.5.1.1.1-3, and A.7.5.1.1.1-4 below. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.1.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.7.5.1.1.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In addition to RLM-RS radio link monitoring using SSB index 0 and SSB index 1, the UE is configured to perform inter-frequency measurements using Gap Pattern ID #0 (40ms) in test 1.

Table A.7.5.1.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.1.1-2: General test parameters for FR2 out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1		100: $N_{RB,c}$ = 66
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
TDD Configuration	Config 1		TDDConf.3.1
CORESET Reference Channel	Config 1		CR.3.1 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
PRACH Configuration	Config 1		Table A.3.8.3.4
SSB index assigned as RLM RS	Config 1		0,1
OCNG parameters			OP.2
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			*gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1		TRS.2.1 TDD
T1		s	0.2
T2		s	9.68
T3		s	9.68
D1		s	9.64
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.1.1.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 3 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams [Note 5]			Rough			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4			Not sent		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0					
EPRE ratio of PBCH DMRS to SSS		dB						
EPRE ratio of PBCH to PBCH DMRS		dB						
EPRE ratio of PSS to SSS		dB						
EPRE ratio of PDSCH DMRS to SSS		dB						
EPRE ratio of PDSCH to PDSCH DMRS		dB						
EPRE ratio of OCNG DMRS to SSS		dB						
EPRE ratio of OCNG to OCNG DMRS		dB						
ssb-Index 0 SNR	Config 1	dB	2 [Note 6]	-6 [Note 6]	-15			
ssb-Index 1 SNR	Config 1		Not sent			2 [Note 6]	-15	-15
SNR on other channels and signals	Config 1	dB	2 [Note 6]			N/A		
N_{oc}	Config 1	dBm/15kHz	-92.1			-92.1		
Time multiplexing of the downlink transmissions from each AoA			Defined in Figure A.7.5.1.1.1-2					
Propagation condition			TDL-A 30ns 75Hz			TDL-A 30ns 75Hz		

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 5: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.
Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband

Table A.7.5.1.1.1-4: Measurement gap configuration for out-of-sync tests in non-DRX mode

Field	Test 1
	Value
gapOffset	0

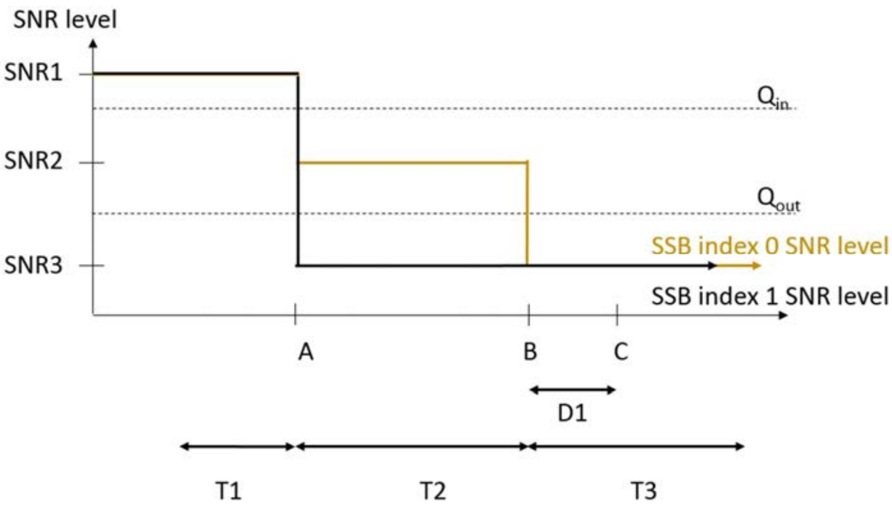


Figure A.7.5.1.1.1-1: SNR variation for out-of-sync testing

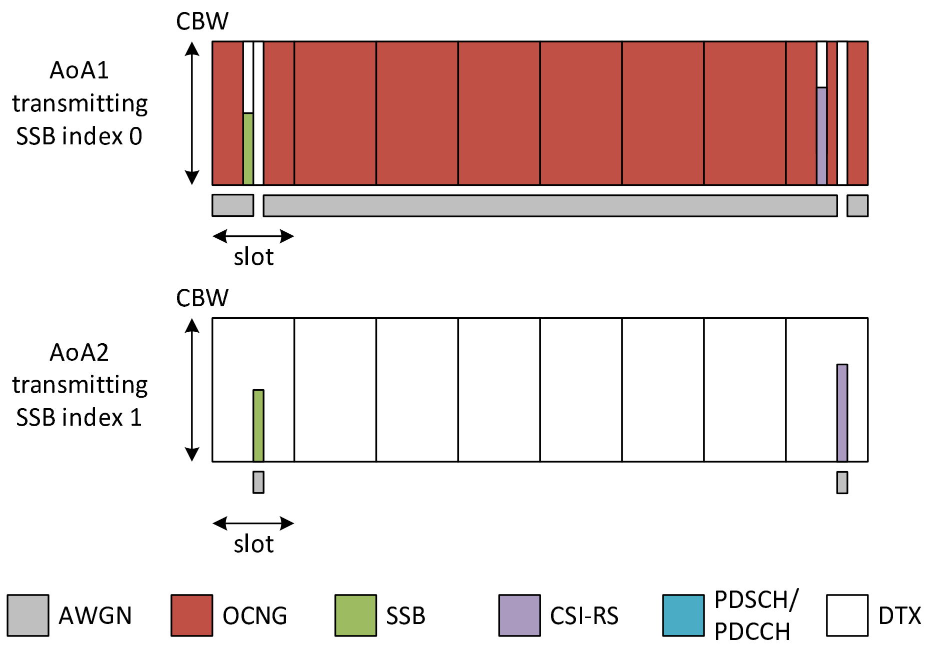


Figure A.7.5.1.1.1-2: Time multiplexed downlink transmissions

A.7.5.1.1.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.1.2 Radio Link Monitoring In-sync Test for FR2 PCell configured with SSB-based RLM RS in non-DRX mode

A.7.5.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.2.1-1.The test parameters are given in Tables A.7.5.1.2.1-2, and A.7.5.1.2.1-3 below. There is one cell (Cell 1), which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.2.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states, and Figure A.7.5.1.2.1-2 shows the Time multiplexed downlink transmissions from each Angle of Arrival. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms.

Table A.7.5.1.2.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.2.1-2: General test parameters for FR2 in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1		100: $N_{RB,c}$ = 66
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
TDD Configuration	Config 1		TDDConf.3.1
CORESET Reference Channel	Config 1		CR.3.1 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.3
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
PRACH Configuration	Config 1		Table A.3.8.3.4
SSB index assigned as RLM RS	Config 1		0,1
OCNG parameters			OP.2
CP length			Normal
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			*OFF*
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	4000
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1		TRS.2.1 TDD
T1		s	0.2
T2		s	0.2

T3	s	1.88
T4	s	0.2
T5	s	3.84
D1	s	3.8
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.		

Table A.7.5.1.2.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for in-sync radio link monitoring tests in non-DRX mode

Parameter		Unit	Test 1									
			T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
AoA setup			Setup 3 defined in A.3.15									
			AoA1					AoA2				
Assumption for UE beams Note 5			Rough					Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	4					Not sent				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0									
EPRE ratio of PBCH DMRS to SSS		dB										
EPRE ratio of PBCH to PBCH DMRS		dB										
EPRE ratio of PSS to SSS		dB										
EPRE ratio of PDSCH DMRS to SSS		dB										
EPRE ratio of PDSCH to PDSCH DMRS		dB										
EPRE ratio of OCNG DMRS to SSS		dB										
EPRE ratio of OCNG to OCNG DMRS		dB										
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15	-4.5	2 Note 6					
ssb-Index 1 SNR	Config 1		Not sent					2 Note 6	-15	-15	-15	-15
SNR on other channels and signals	Config 1	dB	2 Note 6					N/A				
N_{oc}	Config 1	dBm/15kHz	-92.1					-92.1				
Time multiplexing of the downlink transmissions from each AoA			Defined in Figure A.7.5.1.2.1-2									
Propagation condition			TDL-A 30ns 75Hz					TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 5: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.
Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband

Table A.7.5.1.2.1-4: Void

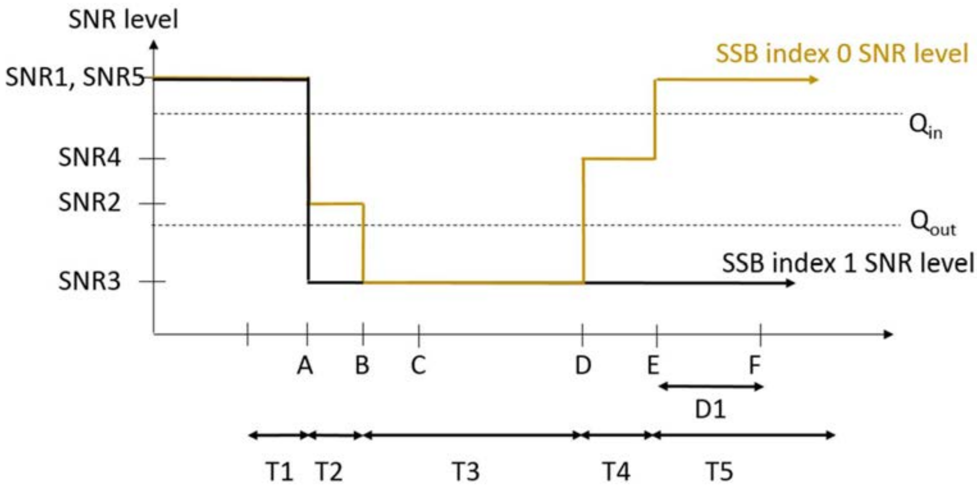


Figure A.7.5.1.2.1-1: SNR variation for in-sync testing

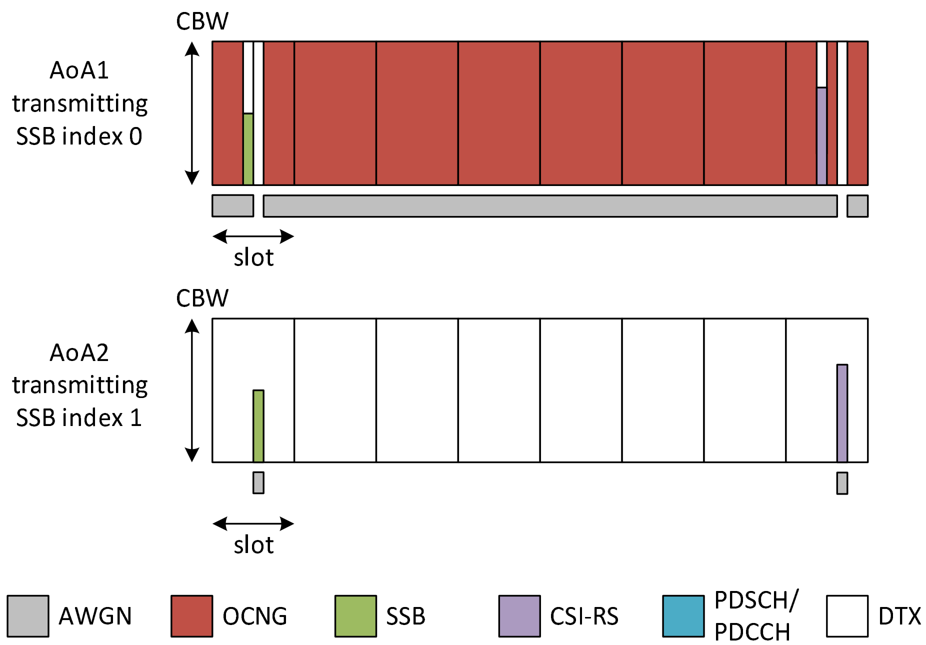


Figure A.7.5.1.2.1-2: Time multiplexed downlink transmissions

A.7.5.1.2.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.1.3 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with SSB-based RLM RS in DRX mode

A.7.5.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.3.1-1. The test parameters are given in Tables A.7.5.1.3.1-2, and A.7.5.1.3.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.3.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.7.5.1.3.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.3.1-2: General test parameters for FR2 out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
$BW_{channel}$	Config 1		100: $N_{RB,c}$ = 66
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
TDD Configuration	Config 1		TDDConf.3.1
CORESET Reference Channel	Config 1		CR.3.1 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
PRACH Configuration	Config 1		Table A.3.8.3.4
SSB index assigned as RLM RS	Config 1		0,1
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX Configuration			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
TCI states for PDCCH/PDSCH			TCI.State.2
CSI-RS for tracking	Config 1		TRS.2.1 TDD
T1		s	0.2
T2		s	14.48
T3		s	14.48
D1		s	14.44
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.1.3.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for out-of-sync radio link monitoring tests in DRX mode

Parameter		Unit	Test 1		
			T1	T2	T3
AoA setup			Setup 1 defined in A.3.15		
Assumption for UE beams Note 5			Rough		
EPRE ratio of PDCCH DMRS to SSS		dB	4		
EPRE ratio of PDCCH to PDCCH DMRS		dB	0		
EPRE ratio of PBCH DMRS to SSS		dB	0		
EPRE ratio of PBCH to PBCH DMRS		dB			
EPRE ratio of PSS to SSS		dB			
EPRE ratio of PDSCH DMRS to SSS		dB			
EPRE ratio of PDSCH to PDSCH DMRS		dB			
EPRE ratio of OCNG DMRS to SSS		dB			
EPRE ratio of OCNG to OCNG DMRS		dB			
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15
ssb-Index 1 SNR	Config 1		2 Note 6	-15	-15
SNR on other channels and signals	Config 1	dB	2 Note 6		
N_{oc}	Config 1	dBm/15KHz	-104.7dBm		
Propagation condition			TDL-A 30ns 75Hz		

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 5: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.
Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband.

Table A.7.5.1.3.1-4: Void

Table A.7.5.1.3.1-5: Void

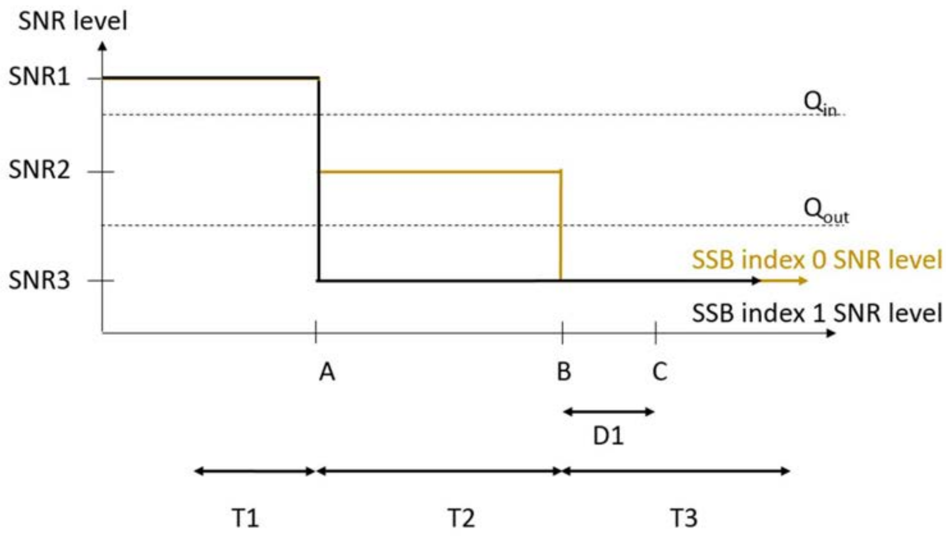


Figure A.7.5.1.3.1-1: SNR variation for out-of-sync testing

A.7.5.1.3.2 Test Requirements

The UE behavior in each test during time durations T1, T2 and T3 shall be as follows:

During the period from time point A to time point B the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The UE shall stop transmitting uplink signal no later than time point C (D1 second after the start of the time duration T3).

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.1.4 Radio Link Monitoring In-sync Test for FR2 PCell configured with SSB-based RLM RS in DRX mode

A.7.5.1.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync and in sync for the purpose of monitoring downlink radio link quality of the PCell when DRX is used. This test will partly verify the FR2 radio link monitoring requirements in clause 8.1.

In the test, UE is configured to perform RLM on SSB, with *detectionResource* included in *RadioLinkMonitoringRS* set to SSB#0 and SSB#1, and *purpose* set to '*rlf*'. Supported test configurations are shown in table A.7.5.1.4.1-1. The test parameters are given in Tables A.7.5.1.4.1-2, and A.7.5.1.4.1-3. There is one cell (Cell 1), which is the active NR cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.4.1-1 shows the variation of the downlink SNR in the active cell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to Cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 5 ms. In the test, DRX configuration is enabled and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CSI during the period when On-duration timer is running. Time alignment timers shall be set to "infinity" so that UL timing alignment is maintained during the test.

Table A.7.5.1.4.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD, SSB SCS 120 KHz, data SCS 120KHz, BW 100 MHz

Table A.7.5.1.4.1-2: General test parameters for FR2 in-sync testing in DRX mode

Parameter			Unit	Value
				Test 1
Active PCell				Cell 1
RF Channel Number				1
Duplex mode		Config 1		TDD
$BW_{channel}$		Config 1		100: $N_{RB,c}$ = 66
DL initial BWP configuration		Config 1		DLBWP.0.1
DL dedicated BWP configuration		Config 1		DLBWP.1.1
UL initial BWP configuration		Config 1		ULBWP.0.1
UL dedicated BWP configuration		Config 1		ULBWP.1.1
TDD Configuration		Config 1		TDDConf.3.1
CORESET Reference Channel		Config 1		CR.3.1 TDD
SSB Configuration		Config 1		SSB.1 FR2
SMTC Configuration		Config 1		SMTC.3
PDSCH/PDCCH subcarrier spacing		Config 1		120 KHz
PRACH Configuration		Config 1		Table A.3.8.3.4
SSB index assigned as RLM RS		Config 1		0,1
OCNG parameters				OP.1
CP length				Normal
In sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	4
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	0
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	0
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
Out of sync transmission parameters	DCI format			1-0
	Number of Control OFDM symbols			2
	Aggregation level		CCE	8
	Ratio of hypothetical PDCCH RE energy to average SSS RE energy		dB	4
	Ratio of hypothetical PDCCH DMRS energy to average SSS RE energy		dB	4
	DMRS precoder granularity			REG bundle size
	REG bundle size			6
DRX Configuration				DRX.11
Gap pattern ID				N.A.
Layer 3 filtering				*Enabled*
T310 timer			ms	4000
T311 timer			ms	1000
N310				1
N311				1
CSI-RS for CSI reporting		Config 1		CSI-RS.3.1 TDD
TCI states for PDCCH/PDSCH				TCI.State.2
CSI-RS for tracking		Config 1		TRS.2.1 TDD
T1			s	0.2
T2			s	0.2

T3	s	2.8
T4	s	0.2
T5	s	3.88
D1	s	3.84
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.		

Table A.7.5.1.4.1-3: OTA related cell specific test parameters for FR2 (Cell 1) for in-sync radio link monitoring test in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 5			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	4				
EPRE ratio of PDCCH to PDCCH DMRS		dB	0				
EPRE ratio of PBCH DMRS to SSS		dB	0				
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
ssb-Index 0 SNR	Config 1	dB	2 Note 6	-6 Note 6	-15	-4.5	2 Note 6
ssb-Index 1 SNR	Config 1		2 Note 6	-15	-15	-15	-15
SNR on other channels and signals	Config 1	dB	2 Note 6				
N_{oc}	Config 1	dBm/15KHz	-104.7dBm				
Propagation condition			TDL-A 30ns 75Hz				
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: The signal contains PDCCH for UEs other than the device under test as part of OCNG.3 Note 3: SNR levels correspond to the signal to noise ratio over the SSS REs. Note 4: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6. Note 5: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation. Note 6: This value allows up to 1dB degradation from applied SNR to UE baseband.							

Table A.7.5.1.4.1-4: Void

Table A.7.5.1.4.1-5: Void

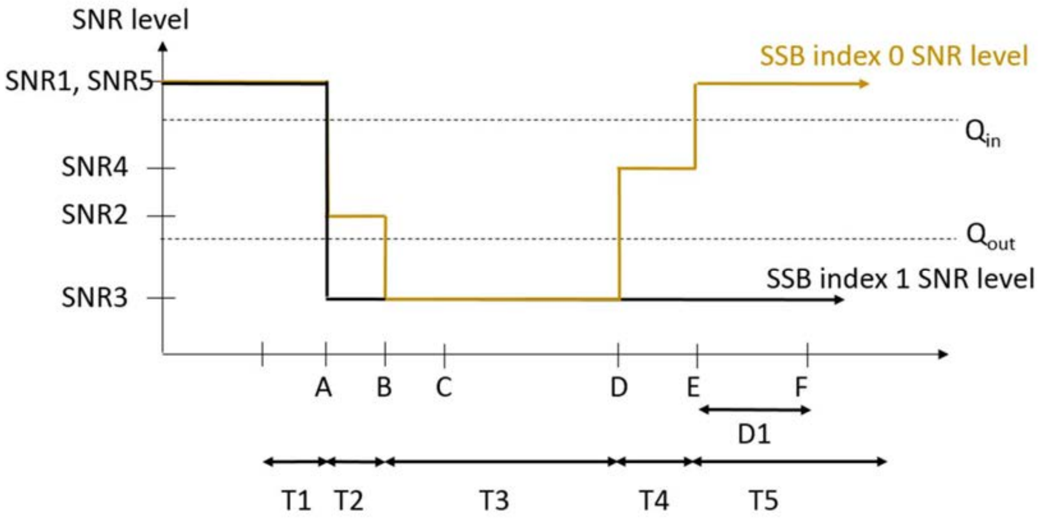


Figure A.7.5.1.4.1-1: SNR variation for in-sync testing

A.7.5.1.4.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting.

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.1.5 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with CSI-RS-based RLM in non-DRX mode

A.7.5.1.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR2 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.5.1-1, A.7.5.1.5.1-2, A.7.5.1.5.1-3 and A.7.5.1.5.1-4 below. There is one cell, cell 1 which is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.5.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.7.5.1.5.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.1.5.1-2: General test parameters for FR2 PCell for CSI-RS out-of-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			**gp0*
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
T1		s	0.2
T2		s	0.35
T3		s	0.35
D1		s	0.31
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.1.5.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1					
			T1	T2	T3	T1	T2	T3
AoA setup			Setup 3 defined in A.3.15					
			AoA1			AoA2		
Assumption for UE beams [Note 10]			Rough			Rough		
PDCCH_beta		dB	4			Not sent		
PDCCH_DMRS_beta		dB	4					
PBCH_beta		dB	0					
PSS_beta		dB						
SSS_beta		dB						
PDSCH_beta		dB						
OCNG_beta		dB						
SNR on RLM-RS1	Config 1	dB	2 [Note 11]	-6 [Note 11]	-15			
SNR on RLM-RS2	Config 1		Not sent			2 [Note 11]	-14	-15
SNR on other channels and signals	Config 1	dB	2 [Note 11]			N/A		
N_{oc}	Config 1	dBm/15kHz	-92.1			-92.1		
Propagation condition			TDL-C 300ns 100Hz			TDL-C 300ns 100Hz		

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.1.5.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband

Table A.7.5.1.5.1-4: Measurement gap configuration for FR2 CSI-RS out-of-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
Note 1: RLM RS is partially overlapped with measurement gap	

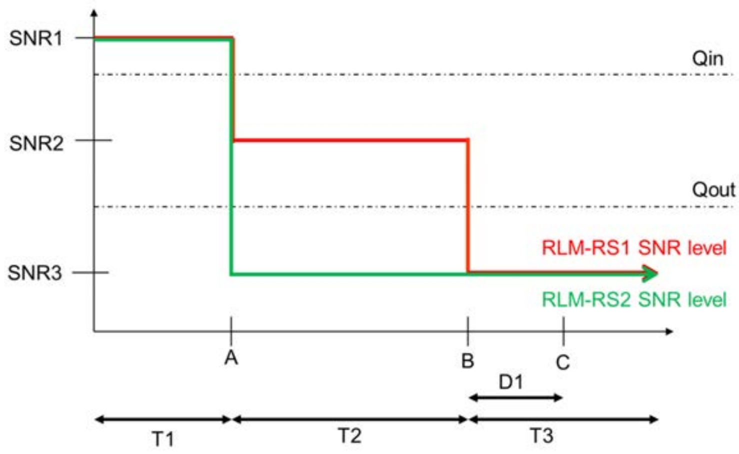


Figure A.7.5.1.5.1-1: SNR variation for CSI-RS out-of-sync testing

A.7.5.1.5.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 no later than time point C (D_1 second after the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.1.6 Radio Link Monitoring In-sync Test for FR2 PCell configured with CSI-RS-based RLM in non-DRX mode

A.7.5.1.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when no DRX is used. This test will partly verify the FR2 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.6.1-1, A.7.5.1.6.1-2 and A.7.5.1.6.1-3 below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.6.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. In the test, DRX configuration is not enabled. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.7.5.1.6.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.1.6.1-2: General test parameters for FR2 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			OFF
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	1000
T311 timer		ms	1000

N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	0.24
T4		s	0.2
T5		s	0.88
D1		s	0.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.1.6.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1									
			T1	**T2**	**T3**	**T4**	**T5**	**T1**	**T2**	**T3**	**T4**	**T5**
AoA setup			Setup 3 defined in A.3.15									
			AoA1					**AoA2**				
Assumption for UE beams Note 10			Rough					Rough				
PDCCH_beta		dB	4					Not sent				
PDCCH_DMRS_beta		dB	4									
PBCH_beta		dB	0									
PSS_beta		dB										
SSS_beta		dB										
PDSCH_beta		dB										
OCNG_beta		dB										
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15	-4.5	2 Note 11					
SNR on RLM-RS2	Config 1		Not sent					2 Note 11	-14	-15	-15	-14
SNR on other channels and signals	Config 1	dB	2 Note 11					N/A				
N_{oc}	Config 1	dBm/15KHz	-92.1					-92.1				
Propagation condition			TDL-C 300ns 100Hz					TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.7.5.1.6.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband.

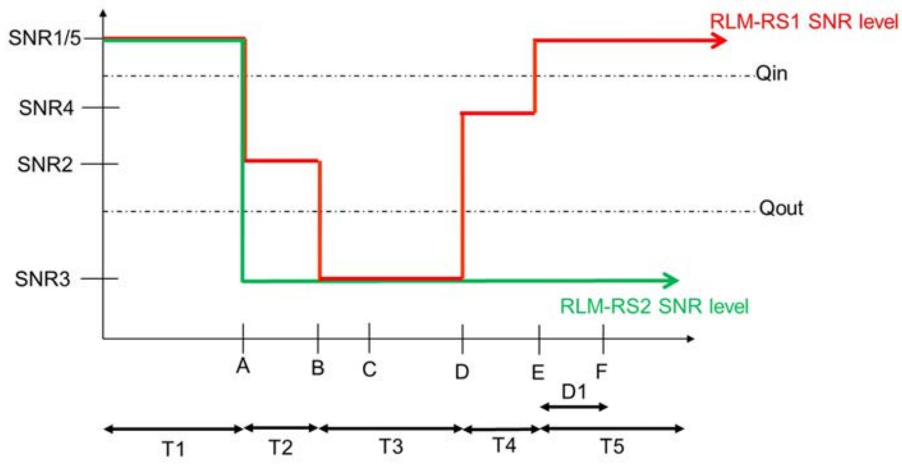


Figure A.7.5.1.6.1-1: SNR variation for CSI-RS in-sync testing

A.7.5.1.6.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.1.7 Radio Link Monitoring Out-of-sync Test for FR2 PCell configured with CSI-RS-based RLM in DRX mode

A.7.5.1.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the out of sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR2 PCell CSI-RS Out-of-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.7.1-1, A.7.5.1.7.1-2, and A.7.5.1.7.1-3 below. There is one cell, cell 1 is the PCell, in the test. The test consists of three successive time periods, with time duration of T1, T2 and T3 respectively. Figure A.7.5.1.7.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.7.5.1.7.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.1.7.1-2: General test parameters for FR2 PCell for CSI-RS out-of-sync testing in DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			N.A.
Layer 3 filtering			*Enabled*
T310 timer		ms	*0*
T311 timer		ms	1000
N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
T1		s	0.2
T2		s	1.28
T3		s	1.28
D1		s	1.24
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.1.7.1-3: Cell specific test parameters for FR2 for CSI-RS out-of-sync radio link monitoring in DRX mode

<table>
<tr><th colspan="2" rowspan="2">Parameter</th><th rowspan="2">Unit</th><th colspan="3">Test 1</th></tr>
<tr><th>T1</th><th>T2</th><th>T3</th></tr>
<tr><td colspan="2">AoA setup</td><td>dB</td><td colspan="3">Setup 1 defined in A.3.15</td></tr>
<tr><td colspan="2">Assumption for UE beams Note 10</td><td></td><td colspan="3">Rough</td></tr>
<tr><td colspan="2">PDCCH_beta</td><td>dB</td><td colspan="3">4</td></tr>
<tr><td colspan="2">PDCCH_DMRS_beta</td><td>dB</td><td colspan="3">4</td></tr>
<tr><td colspan="2">PBCH_beta</td><td>dB</td><td colspan="3" rowspan="5">0</td></tr>
<tr><td colspan="2">PSS_beta</td><td>dB</td></tr>
<tr><td colspan="2">SSS_beta</td><td>dB</td></tr>
<tr><td colspan="2">PDSCH_beta</td><td>dB</td></tr>
<tr><td colspan="2">OCNG_beta</td><td>dB</td></tr>
<tr><td>SNR on RLM-RS1</td><td>Config 1</td><td>dB</td><td>2 Note 11</td><td>-6 Note 11</td><td>-15</td></tr>
<tr><td>SNR on RLM-RS2</td><td>Config 1</td><td>dB</td><td>2 Note 11</td><td>-14</td><td>-15</td></tr>
<tr><td>SNR on other channels and signals</td><td>Config 1</td><td>dB</td><td colspan="3">2 Note 11</td></tr>
<tr><td>N_{oc}</td><td>Config 1</td><td>dBm/15KHz</td><td colspan="3">-104.7</td></tr>
<tr><td colspan="2">Propagation condition</td><td></td><td colspan="3">TDL-C 300ns 100Hz</td></tr>
<tr><td colspan="6">Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2 and T3 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.1.7.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is specified in clause A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband.</td></tr>
</table>

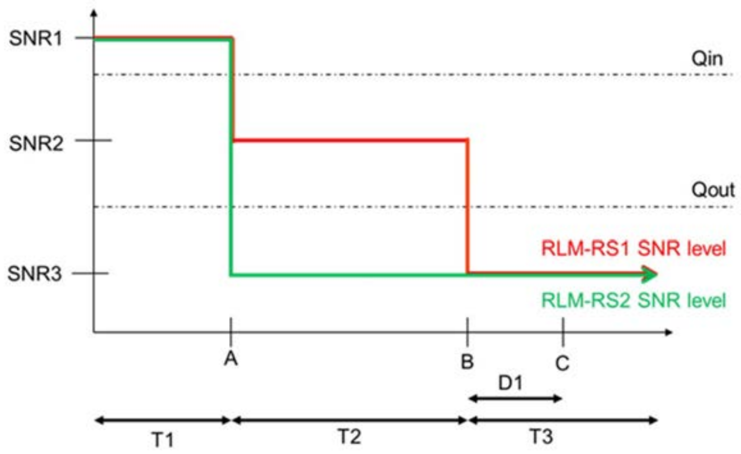


Figure A.7.5.1.7.1-1: SNR variation for CSI-RS out-of-sync testing

A.7.5.1.7.2 Test Requirements

The UE behaviour during time durations T1, T2, and T3 shall be as follows:

During time durations T1, T2 and T3, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on PCell.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 (PCell) at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

The UE shall stop transmitting uplink signal in Cell 1 (PCell) no later than time point C (D_1 secondafter the start of the time duration T3) on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.1.8 Radio Link Monitoring In-sync Test for FR2 PCell configured with CSI-RS-based RLM in DRX mode

A.7.5.1.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects the in sync for the purpose of monitoring downlink CSI-RS based radio link quality of the PCell when DRX is used. This test will partly verify the FR2 PCell CSI-RS In-sync radio link monitoring requirements in clause 8.1.

The test parameters are given in Tables A.7.5.1.8.1-1, A.7.5.1.8.1-2, A.7.5.1.8.1-3 and A.7.5.1.8.1-4 below. There is one cells, cell 1which is the PCell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.1.8.1-1 shows the variation of the downlink SNR in the PCell to emulate out-of-sync and in-sync states. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 10 ms. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test. In the test, SSB0 and SSB1 are configured as BFD-RS.

Table A.7.5.1.8.1-1: Supported test configurations for FR2 PSCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.1.8.1-2: General test parameters for FR2 PCell for CSI-RS in-sync testing in non-DRX mode

Parameter		Unit	Value
			Test 1
Active PCell			Cell 1
RF Channel Number			1
Duplex mode	Config 1		TDD
TDD Configuration	Config 1		TDDConf.3.1
DL initial BWP configuration	Config 1		DLBWP.0.1
DL dedicated BWP configuration	Config 1		DLBWP.1.1
UL initial BWP configuration	Config 1		ULBWP.0.1
UL dedicated BWP configuration	Config 1		ULBWP.1.1
CORESET Reference Channel	Config 1		CCR.3.1 TDD CCR.3.3 TDD
SSB Configuration	Config 1		SSB.1 FR2
SMTC Configuration	Config 1		SMTC.1
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz
CSI-RS for RLM	Config 1		Resource #4 in TRS.2.1 TDD Resource #4 in TRS.2.2 TDD
TRS configuration			TRS.2.1 TDD TRS.2.2 TDD
TCI configuration for PDCCH#1/PDSCH			TCI.State.2
TCI configuration for PDCCH#2			TCI.State.3
OCNG parameters			OP.1
CP length			Normal
Out of sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	8
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	4
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	4
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
In sync transmission parameters	DCI format		1-0
	Number of Control OFDM symbols		2
	Aggregation level	CCE	4
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0
	DMRS precoder granularity		REG bundle size
	REG bundle size		6
DRX			DRX.3
Gap pattern ID			*[*gp0*]
Layer 3 filtering			*Enabled*
T310 timer		ms	*2000*
T311 timer		ms	1000

N310			1
N311			1
CSI-RS for CSI reporting	Config 1		CSI-RS.3.1 TDD
T1		s	0.2
T2		s	0.2
T3		s	1.64
T4		s	0.2
T5		s	1.88
D1		s	1.84
Note 1: UE-specific PDCCH is not transmitted after T1 starts.			

Table A.7.5.1.8.1-3: Cell specific test parameters for FR2 for CSI-RS in-sync radio link monitoring in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup		dB	Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
PDCCH_beta		dB	4				
PDCCH_DMRS_beta		dB	4				
PBCH_beta		dB	0				
PSS_beta		dB					
SSS_beta		dB					
PDSCH_beta		dB					
OCNG_beta		dB					
SNR on RLM-RS1	Config 1	dB	2 Note 11	-6 Note 11	-15	-4.5	2 Note 11
SNR on RLM-RS1	Config 1	dB	2 Note 11	-14	-15	-15	-14
SNR on RLM-RS1	Config 1	dB	2 Note 11				
N_{oc}	Config 1	dBm/15KHz	-104.7				
Propagation condition			TDL-C 300ns 100Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2, SNR3, SNR4 and SNR5 respectively in figure A.7.5.1.8.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.
Note 11: This value allows up to 1dB degradation from applied SNR to UE baseband.

Table A.7.5.1.8.1-4: Measurement gap configuration for FR2 CSI-RS in-sync radio link monitoring in non-DRX mode

Field	Test 1
	Value
gapOffset	0
Note 1: RLM RS is partially overlapped with measurement gap	

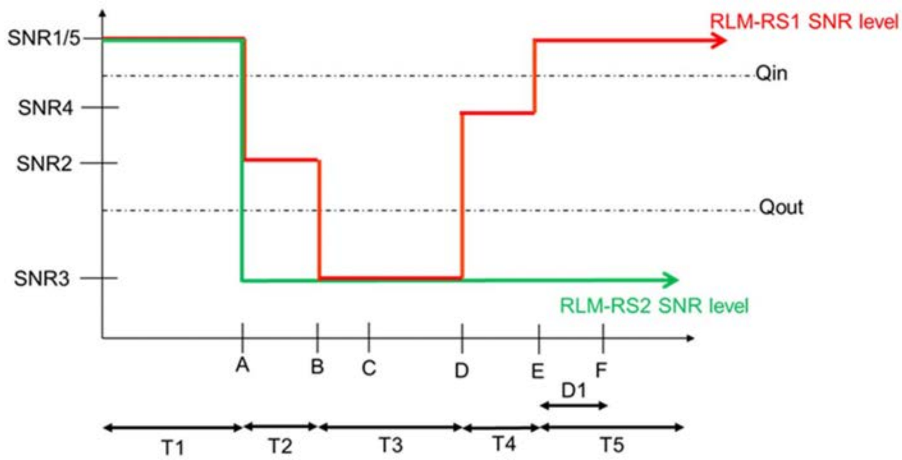


Figure A.7.5.1.8.1-1: SNR variation for CSI-RS in-sync testing

A.7.5.1.8.2 Test Requirements

The UE behaviour in each test during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the period from time point A to time point F (D1 second after the start of time duration T5) the UE shall transmit uplink signal at least in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting on the PCell.

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.1.9 UE Radio Link Monitoring Scheduling Restrictions on FR2

A.7.5.1.9.1 Test Purpose and Environment

The purpose is to verify that the NR UE correctly follows the RLM scheduling restrictions requirements defined in clause 8.1.7. This test verifies that the UE correctly receive the PDCCH scheduled on the symbols right before the RLM SSB symbols without overlap so that it sends ACK/NACK correctly. The test case is only applicable to UE which supports pdcch-MonitoringAnyOccasions or pdcch-MonitoringAnyOccasionsWithSpanGap.

The test parameters are given in table A.7.5.1.9.1-1, table A.7.5.1.9.1-2 and table A.7.5.1.9.1-3 below. The UE is required during time period T1 to transmit ACK/NACK correctly upon scheduling of PDSCH.

Table A.7.5.1.9.1-1: Supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 120 kHz RMC SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.1.9.1-2: General test parameters for NR RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Value	Comment
RF Channel Number		1	1	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC pattern 1	
DRX cycle length	s	1	OFF	
T1	s	1	5	During T1 the UE is required to correctly transmit ACK/NACK

Table A.7.5.1.9.1-3: Cell specific test parameters for NR RLM scheduling restriction test case in FR2

Parameter	Unit	Test configuration	Cell 1	
AoA setup		1	Setup 3 defined in A.3.15.3	
			AoA1	AoA2
Assumption for UE beams Note 1			Rough	Rough
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	Not sent
RMSI CORESET RMC configuration		1	CR.3.1 TDD	Not sent
Dedicated CORESET RMC configuration		1	CCR.3.2 TDD	Not sent
TRS configuration		1	TRS.2.1 TDD	TRS.2.2 TDD
PDCCH/PDSCH TCI state		1	TCI.State.2	N/A
OCNG Pattern		1	OP.1 defined in A.3.2.1	Not sent
Initial DL BWP configuration		1	DLBWP.0.1	
Initial UL BWP configuration		1	ULBWP.0.1	
RLM-RS		1	SSB with index 0	SSB with index 1
$\hat{E}_s/I_{ot}$	dB	1	3	N/A
N_{oc} Note2	dBm/SCS	1	-84.9	Not sent
$\hat{E}_s/N_{oc}$	dB	1	3	N/A
SS-RSRP Note3	dBm/SCS	1	-81.9	-81.9
Io	dBm/95.04 MHz	1	-51.15	-52.91
Propagation Condition		1	AWGN	-
Note 1: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.				

A.7.5.1.9.2 Test Requirements

The UE behaviour follows the requirements defined in clause 8.1.7.3.

A.7.5.2 Interruption

A.7.5.2.1 Interruptions during measurements on deactivated NR SCC in FR2

A.7.5.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE missed ACK/NACK rate does not exceed the limits at NR PSCell interruptions during the measurement on the deactivated NR SCC. This test will verify the missed ACK/NACK rate for PCell in standalone NR specified in clause 8.2.2.2. Supported test configurations are shown in table A.7.5.2.1.1-1.

The general test parameters and NR cell specific test parameters are given in Table A.7.5.2.1.1-2 and A.7.5.2.1.1-3 below. In the test there are two cells: Cell1 and Cell2. Cell1 is PCell, Cell2 is an NR deactivated SCell. Cell1 shall be configured as PCell and Cell2 shall be configured as SCell.

The test consists of one time period, with duration of T1. Prior to the start of the time duration T1, the UE is connected to Cell1 and Cell2. The point in time at which the RRC message including *measCycleSCell* or *allowInterruptions* for the deactivated NR SCells is received at the UE antenna connector, defines the start of time period T1. During T1, PCell is continuously scheduled in DL.

Table A.7.5.2.1.1-1: Interruptions during measurements on deactivated NR SCC supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD – TDD duplex mode

Table A.7.5.2.1.1-2: General test parameters for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two NR RF channels
Active PCell		Cell1	PCell on NR RF channel number 1.
Configured deactivated SCell		Cell2	Deactivated SCell on NR RF channel number 2.
CP length		Normal	Applicable to Cell1 and Cell2
DRX		OFF	
Measurement gap pattern Id		OFF	
SCell measurement cycle (measCycleSCell)	ms	640	
T1	s	10	

Table A.7.5.2.1.1-3: NR cell specific test parameters for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter	Unit	Cell1	Cell2
Frequency Range		FR2	
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$		100 MHz: $N_{RB,c}$ = 66	
Initial DL BWP Configuration		DLBWP.0.2 Note4	
Initial UL BWP Configuration		ULBWP.0.2 Note6	
Downlink dedicated BWP Configuration		DLBWP.1.1	
Uplink dedicated BWP configuration		ULBWP.1.1	
PDSCH Reference measurement channel		SR.3.1 TDD	
RMSI CORESET parameters		CR.3.1 TDD	
Dedicated CORESET parameters		CCR.3.1 TDD	
OCNG Patterns		OP.1	
SMTC Configuration		SMTC.1	
SSB Configuration		SSB.1 FR2	
TCI State		TCI.State.0	
TRS Configuration		TRS.2.1 TDD	
Correlation Matrix and Antenna Configuration		1x2 Low	
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Time offset to Cell1 Note 3	μs	-	3
Propagation Condition		AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Void
Note 3: Receive time difference between slot boundaries of signals received from the two cells at the UE antenna connector including time alignment error between the two cells.
Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2 defined in clause 12 of of TS 38.213 [3].

Table A.7.5.2.1.1-4: OTA related test parameters for interruptions during measurements on deactivated NR SCC in standalone NR

Parameter		Unit	Cell 1	Cell 2
Angle of arrival configuration			Setup1 according to table A.3.15.1	Setup 1according to table A.3.15.1
Assumption for UE beams Note 6			Rough	Rough
N_{oc} Note1	NR_TDD_FR2_A	dBm/15kHz	-112	-112
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS	-102.97	-102.97
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
SS-RSRP Note2	NR_TDD_FR2_A	dBm/120KHz Note3	-85.97	-85.97
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			
$\hat{E}_s/N_{oc}$		dB	17	17
$\hat{E}_s/I_{ot}$		dB	17	17
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-56.90	-56.90
	NR_TDD_FR2_B			
	NR_TDD_FR2_F			
	NR_TDD_FR2_G			
	NR_TDD_FR2_T			
	NR_TDD_FR2_Y			

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.2.1.2 Test Requirements

The UE shall be continuously scheduled on PCell during the entire length of T1. During the time duration T1 the UE shall transmit at least 99.5% of ACK/NACK on PCell. The UE is only allowed to cause interruptions immediately before and immediately after an SMTC. Each interruption on PCell shall not exceed the value defined in Table

A.7.5.2.1.2-1 if the PCell is not in the same band as the deactivated SCell or Table A.7.5.2.1.2-2 if the PCell is in the same band as the deactivated SCell.

Table A.7.5.2.1.2-1: Interruption duration if the PCell is not in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4

Table A.7.5.2.1.2-2: Interruption duration if the PCell is in the same band as the deactivated SCell

μ	NR Slot length (ms)	Interruption length (slot)
3	0.125	4 + SMTC duration

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.3 SCell Activation and Deactivation Delay

A.7.5.3.1 SCell Activation and deactivation for SCell in FR2 intra-band in non-DRX

A.7.5.3.1.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.6.5.3.1.1 except the PCell and SCell are in FR2 intra-band.

The supported test configurations are shown in table A.7.5.3.1.1-1 below. The general test parameters are the same as defined in Table A.6.5.3.1.1-2 except those described in Tables A.7.5.3.1.1-2, and cell specific test parameters are described in Tables A.7.5.3.1.1-3. OTA related test parameters are shown in table A.7.5.3.1.1-4 below.

Table A.7.5.3.1.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode

Table A.7.5.3.1.1-2: General test parameters for FR2 SCell activation case

Parameter	Unit	Value	Comment
RF Channel Number		1,2	Two NR radio channels are used for this test, cell 1 and cell2 use RF channel 1 and 2, respectively.

Table A.7.5.3.1.1-3: Cell specific test parameters for FR2 SCell activation case

Parameter Note 5	Unit	T1		T2		T3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
Downlink initial BWP Configuration		DLBWP.0.1		DLBWP.0.1		DLBWP.0.1	
Downlink dedicated BWP Configuration		DLBWP.1.1		DLBWP.1.1		DLBWP.1.1	
Uplink initial BWP configuration		ULBWP.0.1		ULBWP.0.1		ULBWP.0.1	
Uplink dedicated BWP configuration		ULBWP.1.1		ULBWP.1.1		ULBWP.1.1	
TRS configuration		TRS.2.1 TDD		TRS.2.1 TDD		TRS.2.1 TDD	
TCI state		TCI.State.0		TCI.State.0		TCI.State.0	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Parameters		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Parameters		CCR.3.1 TDD	-	CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1					
SSB Configuration		SSB.1 FR2					
SMTC Configuration		SMTC.1					
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS Note 1							
EPRE ratio of OCNG to OCNG DMRS Note 1							
Propagation conditions		AWGN					
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: All parameters apply for configuration 1 and 2							

Table A.7.5.3.1.1-4: OTA related test parameters for FR2 SCell activation case

Parameter Note 6	Unit	Cell 1			Cell 2		
		T1	T2	T3	T1	T2	T3
Angle of arrival configuration		Setup 1 according to table A.3.15.1			Setup 1 according to table A.3.15.1		
Assumption for UE beams Note 7		Rough			Rough		
N_{oc} Note1	dBm/15kHz Note4	-112			-112		
N_{oc} Note1	dBm/SCS Note 3	-102.97			-102.97		
$\hat{E}_s/N_{oc}$	dB	14			14		
SS-RSRP Note2	dBm/SCS Note4	-88.97			-88.97		
$\hat{E}_s/I_{ot}$	dB	14			14		
Io Note2	dBm/95.04 MHz Note4	-88.80			-88.80		

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: All parameters apply for configuration 1 and 2
Note 7: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.3.1.2 Test Requirements

The test requirements defined in clause A.6.5.3.1.2 shall apply to this test case, except $T_{activation\_time}$ will be replaced with the value T_{SMTC_SCell} + 5ms as defined in clause 8.3.

A.7.5.3.2 SCell Activation and deactivation for FR1+FR2 inter-band with target SCell in FR2

A.7.5.3.2.1 Test Purpose and Environment

A.7.5.3.2.1 Test Purpose and Environment

The purpose of this test case is the same as for the test defined in clause A.7.5.3.1.1 except the PCell is in FR1 and SCell is in FR2.

The supported test configurations are the same as defined in Table A.7.5.3.2.1-1. The general test parameters are the same as defined in Table A.6.5.3.1.1-2 except that the length of T2 is 2s. And cell specific test parameters are described in Tables A.7.5.3.2.1-2. OTA related test parameters are the same as defined in Table A.7.5.3.2.1-3.

At the beginning of T1 the UE receives an RRC message by which the SCell (Cell 2) becomes configured on NR. During T1 the SCell is powered off and UE is not aware of SCell.

A MAC message for activation of SCell is sent by the test equipment 100ms after the RRC message, in a slot # denoted m. The point in time at which the MAC message for activation of SCell is received at the UE antenna connector defines the start of time period T2. Immediately at beginning of T2 the transmission power of Cell 2 is increased to same level as for cell 2.

During T2, the test equipment monitors the L1-RSRP measurement reporting for the SCell. The time when test equipment receives a valid L1-RSRP report is denoted as slot $m+T_{L1\text{-}RSRP}$. In the next DL slot after slot $m+T_{L1\text{-}RSRP}$, the test equipment sends a MAC message for the activation of the TCI state of the RMC CORESET of the SCell. In the same slot, the test equipment also sends an RRC message to configure the CSI-RS resources for SCell.

Time period T3 starts when a MAC message for deactivation of the SCell, sent from the test equipment to the UE in a slot # denoted n, is received at the UE antenna connector.

The test equipment verifies that potential interruption is carried out in the correct time span by monitoring ACK/NACK sent in PCell and PCell during activation of SCell, respectively.

The test equipment verifies the activation time by counting the slots from the time when the SCell activation command is sent until a CSI report with other than CQI index 0 is received.

The test equipment verifies the deactivation time by counting the slots from the time when the SCell1 deactivation command is sent until CSI reporting for SCell1 is discontinued.

Table A.7.5.3.2.1-1: Supported test configurations for FR2 SCell activation case

Configuration	Description
1	PCell: 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode Target SCell: 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
2	PCell: 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
3	PCell: 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode Target SCell: 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
Note: The UE is only required to pass in one of the supported test configurations	

Table A.7.5.3.2.1-2: Cell specific test parameters for FR2 SCell activation case

Parameter Note 5		Unit	T1		T2		T3	
			Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			Freq1	Freq2	Freq1	Freq2	Freq1	Freq2
Duplex mode	Config 1		FDD	TDD	FDD	TDD	FDD	TDD
	Config 2,3		TDD					
TDD configuration	Config 1		Not Applicable	TDDConf.3.1	Not Applicable	TDDConf.3.1	Not Applicable	TDDConf.3.1
	Config 2,3		TDDConf.1.1		TDDConf.1.1		TDDConf.1.1	
Downlink initial BWP Configuration	Config 1,2,3		DLBWP.0.1					
Downlink dedicated BWP Configuration	Config 1,2,3		DLBWP.1.1	DLBWP.1.1	DLBWP.1.1	DLBWP.1.1	DLBWP.1.1	DLBWP.1.1
Uplink initial BWP configuration	Config 1,2,3		ULBWP.0.1	ULBWP.0.1	ULBWP.0.1	ULBWP.0.1	ULBWP.0.1	ULBWP.0.1
Uplink dedicated BWP configuration	Config 1,2,3		ULBWP.1.1	ULBWP.1.1	ULBWP.1.1	ULBWP.1.1	ULBWP.1.1	ULBWP.1.1
TRS configuration	Config 1,2,3		N/A	TRS.2.1 TDD	N/A	TRS.2.1 TDD	N/A	TRS.2.1 TDD
TCI state	Config 1,2,3		TCI.State.0	TCI.State.0	TCI.State.0	TCI.State.0	TCI.State.0	TCI.State.0
$BW_{channel}$	Config 1,2	MHz	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66
	Config 3		40: $N_{RB,c}$ = 106		40: $N_{RB,c}$ = 106		40: $N_{RB,c}$ = 106	
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	-	SR.1.1 FDD	-	SR.1.1 FDD	-
	Config 2		SR.1.1 TDD		SR.1.1 TDD		SR.1.1 TDD	
	Config 3		SR.2.1 TDD		SR.2.1 TDD		SR.2.1 TDD	
RMSI CORESET Parameters	Config 1		CR.1.1 FDD	-	CR.1.1 FDD	-	CR.1.1 FDD	-
	Config 2		CR.1.1 TDD		CR.1.1 TDD		CR.1.1 TDD	
	Config 3		CR.2.1 TDD		CR.2.1 TDD		CR.2.1 TDD	
Dedicated CORESET Parameters	Config 1		CCR.1.1 FDD	-	CCR.1.1 FDD	-	CCR.1.1 FDD	-
	Config 2		CCR.1.1 TDD		CCR.1.1 TDD		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD		CCR.2.1 TDD		CCR.2.1 TDD	
OCNG Patterns			OP.1					
SSB configuration	Config 1,2		SSB.1 FR1	SSB.3 FR2	SSB.1 FR1	SSB.3 FR2	SSB.1 FR1	SSB.3 FR2
	Config 3		SSB.2 FR1		SSB.2 FR1		SSB.2 FR1	
CSI-RS configuration	Config 1~3		NA	NA	NA	CSI-RS.3.1 TDD Note 6	NA	CSI-RS.3.1 TDD
CSI reporting periodicity Note 7	Config 1~6	ms	NA	5	NA	5	NA	5
SMTC configuration			SMTC.1					
EPRE ratio of PSS to SSS		dB	0					

EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS[Note 1]							
EPRE ratio of OCNG to OCNG DMRS [Note 1]							
Propagation conditions		NA Link only, see clause A.3.7A	AWGN	NA Link only, see clause A.3.7A	AWGN	NA Link only, see clause A.3.7A	AWGN

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Note 5: All parameters apply for configuration 1 and 2

Note 6: CSI-RS for CSI measurement is (re)configured in the next DL slot after slot $m+T_{L1\text{-}RSRP}$ during T2.

Note 7: L1-RSRP measurement and reporting are configured to the the UE prior to the start of time period T1.

Table A.7.5.3.2.1-3: OTA related test parameters for FR1 PCell activation case with FR2 SCell

Parameter		Unit	Cell 2			Cell 1		
			T1	T2	T3	T1	T2	T3
Angle of arrival configuration			Setup 1 according to clause A.3.15.1			NA Link only, see clause A.3.7A		
Assumption for UE beams Note 7			Rough					
N_{oc} Note1		dBm/15kHz	-112					
N_{oc} Note1	Config 1,2	dBm/SCS	-102.97					
	Config 3,							
SS-RSRP Note2	Config 1,2	dBm/SCS Note3	-85.97					
	Config 3							
$\hat{E}_s/N_{oc}$	Config 1,2,3	dB	17					
$\hat{E}_s/I_{ot}$		dB	17					
Io Note2	Config 1,2	dBm/ChBW Note4,Note6	-56.90					
	Config 3							

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: ChBW is 94.04 MHz for Cell2, 9.36 MHz for Cell 3 in configurations 1,2,4,5, 38.1 MHz in configurations 3,6
Note 7: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.3.2.2 Test Requirements

During T2 the UE shall send the first CSI report for SCell in the first available uplink resource after slot (m+k). UE is allowed to postpone CSI report to next available UL resource if an available uplink resource is subject to interruption. Whether CSI report in a slot was interrupted is checked by monitoring ACK/NACK sent in PCell in the slot.

During T2 the UE shall start sending valid L1-RSRP report for the SCell in the configured slots for CSI reporting after slot ($m+T_{L1\text{-}RSRP}$), where $T_{L1\text{-}RSRP}$ is no larger than

$3ms + T_{FirstSSB\_MAX} + 15*T_{SMTC\_MAX} + 8*T_{rs} + T_{L1\text{-}RSRP,\ measure} + T_{L1\text{-}RSRP,\ report}$

as defined in clause 8.3.2. For this test case, $T_{FirstSSB\_MAX}=T_{SMTC\_MAX}=T_{rs}=20ms$; $T_{L1\text{-}RSRP,\ measure}=480ms$ and $T_{L1\text{-}RSRP,\ measure}=5ms$, which allows $T_{L1\text{-}RSRP}$ 1000ms.

During T2 the UE shall start sending CSI reports for the SCell with non-zero CQI index in the configured slots for CSI reporting no later than slot $m + \frac{T_{HARQ}+T_{activtion\_time}+T_{CSI\_Reporting}}{NR\ slot\ length}$, where

- T_{HARQ} is defined in Table A.5.5.3.1.1-2

- $T_{activation\_time} = 3ms + T_{FirstSSB\_MAX} + 15*T_{SMTC\_MAX} + 8*T_{rs} + T_{L1\text{-}RSRP,\ measure} + T_{L1\text{-}RSRP,\ report} + \max\{(T_{HARQ} + T_{uncertainty\_MAC} + 5ms + T_{FineTiming}), (T_{uncertainty\_RRC} + T_{RRC\_delay})\}$, which allows 1030ms

- $T_{CSI\_Reporting}$ = 10ms

- NR slot length is 0.125ms for this test case.

During T3 the UE shall stop sending CSI reports for both SCells no later than slot $\mathrm{n} + \frac{\mathrm{T_{HARQ}+3ms}}{NR\ slot\ length}$, as defined in clause 8.3.

During T2 interruption of PCell during SCell activation shall not happen outside the slot $m + 1 + \frac{T_{\mathrm{HARQ}}}{\mathrm{NR\ slot\ length}}$ to $m + 1 + \frac{T_{\mathrm{HARQ}}+3\mathrm{ms}+T_{\mathrm{X}}}{\mathrm{NR\ slot\ length}}$, as defined in clause 8.3, where T_X =20ms.

During T3 the starting point of interruption of PCell during SCell deactivation shall not happen outside the slot $\mathrm{n} + 1 + \frac{\mathrm{T_{HARQ}}}{NR\ slot\ length}$ to $\mathrm{n} + 1 + \frac{\mathrm{T_{HARQ}+3ms}}{NR\ slot\ length}$, as defined in clause 8.3.

The interruption of PCell due to activation of SCell shall not be more than the values specified for SA in Clause 8.2.2.2.7.

A.7.5.4 Void

A.7.5.5 Beam Failure Detection and Link recovery procedures

A.7.5.5.1 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode

A.7.5.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.1.1-1, A.7.5.5.1.1-2, A.7.5.5.1.1-3 and A.7.5.5.1.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.1.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.7.5.5.1.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is not enabled. The UE is configured to perform inter-frequency measurements using GP ID #0 (40ms) in test 1.

Table A.7.5.5.1.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.7.5.5.1.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1, 2		TDD	
$BW_{channel}$	Config 1, 2		100: $N_{RB,c}$ = 66	
DL initial BWP configuration	Config 1, 2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1	
TDD Configuration	Config 1, 2		TDDConf.3.1	
CORESET Reference Channel	Config 1, 2		CR. 3.1 TDD	
SSB Configuration	Config 1		SSB.1 FR2	
	Config 2		SSB.2 FR2	
SMTC Configuration	Config 1, 2		SMTC.3	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.3.4	
SSB index assigned as BFD RS (q_0)			0	
SSB index assigned as CBD RS (q_1)			1	
TCI Configuration	Config 1, 2		TBD	
OCNG parameters			OP.1	
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	

	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			gp0	
gapOffset			0	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1	dBm/SSB SCS	-94.5	Threshold used for $Q_{in\_LR\_SSB}$
	Config 2		-91.5	
powerControlOffsetSS				Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD	
TCI states			TCI.State.0	
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD	
SSB index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	2.61	
T3		s	1.64	
T4		S	0	
T5		s	1.01	
D1		s	0.97	
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.				

Editor's note: An additional RS for RLM, different from BFD-RS at constant high SNR shall be configured as part of the test configuration.

Table A.7.5.5.1.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
	Config 2		0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1	dBm/SSB SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1	dBm/120 KHz	-104.7				
	Config 2		-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Measurement gap configuration is assigned to the UE prior to the start of time period T1.
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE hich supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

Table A.7.5.5.1.1-4: Void

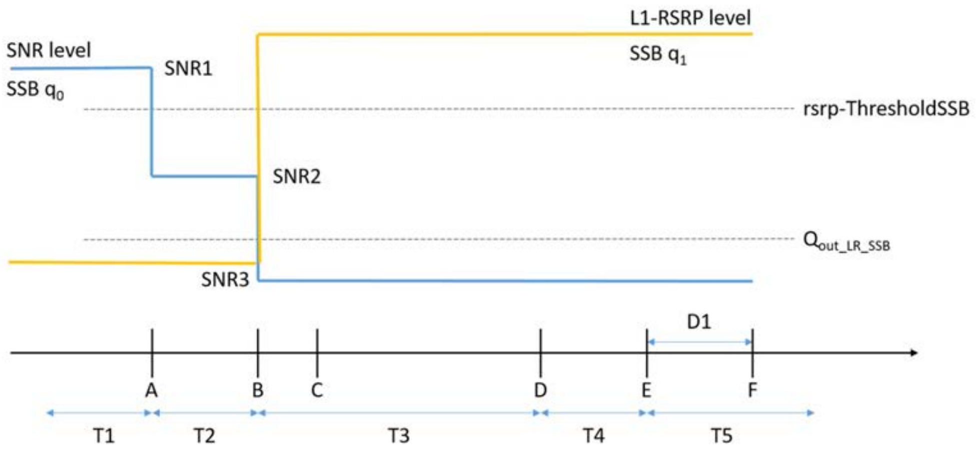


Figure A.7.5.5.1.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.1.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 960+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.5.2 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with SSB-based BFD and LR in DRX mode

A.7.5.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects SSB-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct SSB-based link recovery based on beam candidate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the SSB based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.2.1-1, A.7.5.5.2.1-2, A.7.5.5.2.1-3, A.7.5.5.2.1-4 and A.7.5.5.2.1-5 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.2.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.7.5.5.2.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PCell and

DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.7.5.5.2.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth
2	TDD duplex mode, 240 kHz SSB SCS, 100 MHz bandwidth
Note: The UE is only required to pass in one of the supported test configurations in FR2	

Table A.7.5.5.2.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter	Unit	Value	Comment
		Test 1	

Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1, 2		TDD	
$BW_{channel}$	Config 1, 2		100: $N_{RB,c}$ = 66	
DL initial BWP configuration	Config 1, 2		DLBWP.0.1	
DL dedicated BWP configuration	Config 1, 2		DLBWP.1.1	
UL initial BWP configuration	Config 1, 2		ULBWP.0.1	
UL dedicated BWP configuration	Config 1, 2		ULBWP.1.1	
TDD Configuration	Config 1, 2		TDDConf.3.1	
CORESET Reference Channel	Config 1, 2		CR. 3.1 TDD	
SSB Configuration	Config 1		SSB.1 FR2	
	Config 2		SSB.2 FR2	
SMTC Configuration	Config 1, 2		SMTC.3	
PDSCH/PDCCH subcarrier spacing	Config 1, 2		120 KHz	
PRACH Configuration	Config 1, 2		Table A.3.8.3.4	
SSB index assigned as BFD RS (q_0)			0	
SSB index assigned as CBD RS (q_1)			1	
TCI Configuration	Config 1, 2		TBD	
OCNG parameters			OP.1	
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.3	A.3.3.3
Gap pattern ID			N.A.	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB	Config 1	dBm/SSB SCS	-94.5	Threshold used for $Q_{in\_LR\_SSB}$
	Config 2		-91.5	
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]

beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for CSI reporting	Config 1, 2		CSI-RS.3.1 TDD	A.3.14.2
TCI states			TCI.State.0	
CSI-RS for tracking	Config 1, 2		TRS.2.1 TDD	
SSB index assigned as RLM RS			0, 1	
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	3.37	
T3		s	2.8	
T4		s	0	
T5		s	0.61	
D1		s	0.57	
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.2.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
	Config 2		5	-3	-12	-12	-12
SNR_SSB of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
	Config 2		0.2	0.2	20.2	20.2	20.2
SSB_RP of set q_1	Config 1	dBm/SSB SCS	-104.5	-104.5	-84.5	-84.5	-84.5
	Config 2		-101.5	-101.5	-81.5	-81.5	-81.5
N_{oc}	Config 1	dBm/120 KHz	-104.7				
	Config 2		-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.1.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause [A.3.6].
Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

Table A.7.5.5.2.1-4: Void

Table A.7.5.5.2.1-5: Void

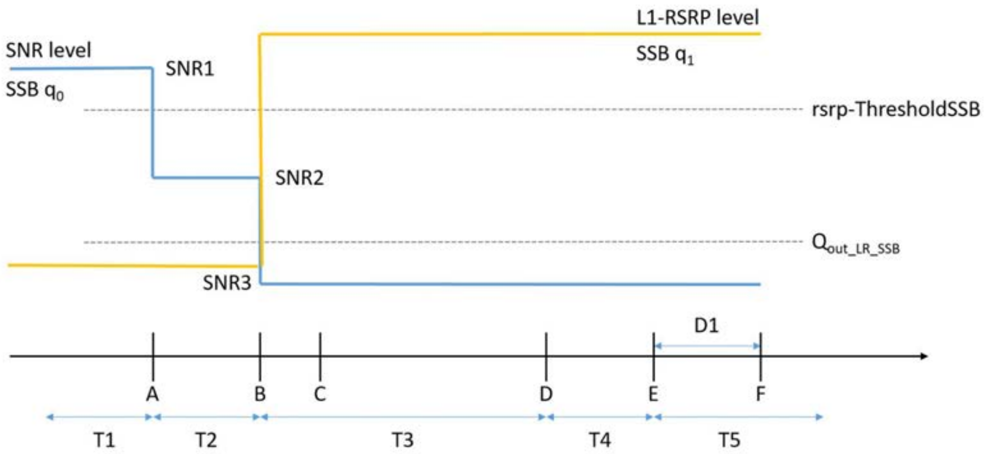


Figure A.7.5.5.2.1-1: SNR and L1-RSRP variation for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.2.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiate link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 560+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.5.3 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in non-DRX mode

A.7.5.5.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when no DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.3.1-1, A.7.5.5.3.1-2, and A.7.5.5.3.1-3 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.3.1-1 shows the variation of the downlink SNR of the CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.7.5.5.3.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of [2] ms. In the test, DRX configuration is not enabled.

Table A.7.5.5.3.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.5.3.1-2: General test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
CORESET Reference Channel	Config 1		CR.3.1 TDD	A.3.1.2
SSB Configuration	Config 1		SSB.3 FR2	A.3.10
SMTC Configuration	Config 1		SMTC.3	A.3.11
PDSCH/PDCCH subcarrier spacing	Config 1		120KHz	
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
TRS configuration			TRS.2.1 TDD	
TCI configuration			CSI-RS.Config.0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB		dBm/SCS kHz	-94.5	Threshold used for $Q_{in\_LR\_SSB}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS

beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]
beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1	Config 1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.3.1 TDD	A.3.14.2
csi-RS-Index assigned as RLM RS			0, 1	A.3.14.2
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	1.17	
T3		s	0.9	
T4		s	0	
T5		s	0.31	
D1		s	0.27	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.3.1-3: Cell specific test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumptpion for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/15 KHz	-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.3.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

Table A.7.5.5.3.1-4: Void

Table A.7.5.5.3.1-5: Void

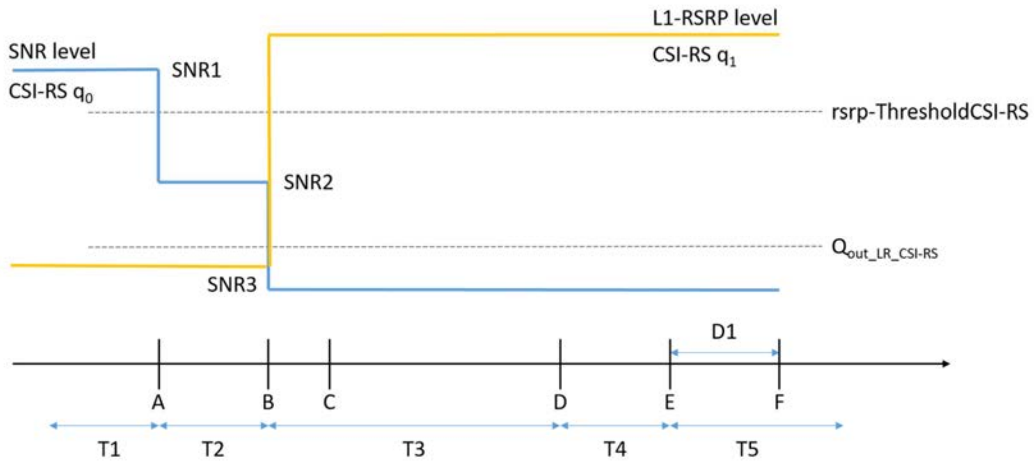


Figure A.7.5.5.3.1-1: SNR and L1-RSRP variation for CSI-RS based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.3.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.5.4 Beam Failure Detection and Link Recovery Test for FR2 PCell configured with CSI-RS-based BFD and LR in DRX mode

A.7.5.5.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE properly detects CSI-RS-based beam failure in the set q_0 configured for a serving cell and that the UE performs correct CSI-RS-based link recovery based on beam candicate set q_1. The purpose is to test the downlink monitoring for beam failure detection within the UEs active DL BWP, during the evaluation period, and link recovery, when DRX is used. This test will partly verify the CSI-RS based beam failure detection and link recovery for an FR2 serving cell requirements in clause 8.5.

The test parameters are given in Tables A.7.5.5.4.1-1, A.7.5.5.4.1-2, A.7.5.5.4.1-3, and A.7.5.5.4.1-4 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.4.1-1 shows the variation of the downlink SNR of the

CSI-RS in set q_0 in the active cell to emulate CSI-RS based beam failure. Figure A.7.5.5.4.1-1 additionally shows the variation of the downlink L1-RSRP of the CSI-RS in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity of 2 ms. In the test, DRX configuration is enabled in PCell and DRX inactivity timer has already been expired, i.e. UE tries to decode PDCCH and to send periodic CQI during the period when On-duration timer is running. Time alignment timers shall be set to “infinity” so that UL timing alignment is maintained during the test.

Table A.7.5.5.4.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	TDD duplex mode, 120 kHz SSB SCS, 100 MHz bandwidth

Table A.7.5.5.4.1-2: General test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
CORESET Reference Channel	Config 1		CR.3.1 TDD	A.3.1.2
SSB Configuration	Config 1		SSB.3 FR2	A.3.10
SMTC Configuration	Config 1		SMTC.3	A.3.11
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz	
csi-RS-Index assigned as beam failure detection RS in set q_0			0	
TRS configuration			TRS.2.1 TDD	
TCI configuration			CSI-RS.Config.0	
OCNG parameters			OP.1	A.3.2.1
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			DRX.3	A.3.3.3
Gap pattern ID			N.A.	
csi-RS-Index assigned as candidate beam detection RS in set q_1			1	
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the value 0. (Table 8.1.1-1).
rsrp-ThresholdSSB		dBm/SCS kHz	-94.5	Threshold used for $Q_{in\_LR\_SSB}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see clause 5.17 of TS 38.321 [7]

beamFailureDetectionTimer			pbfd4	see clause 5.17 of TS 38.321 [7]
CSI-RS configuration for q_0 and q_1	Config 1		CSI-RS.3.2 TDD	A.3.14.2
CSI-RS configuration for CSI reporting	Config 1		CSI-RS.3.1 TDD	A.3.14.2
csi-RS-Index assigned as RLM RS	Config 1		CSI-RS.3.2 TDD	A.3.14.2
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	5.43	
T3		s	5.16	
T4		s	0	
T5		s	0.31	
D1		s	0.27	
Note 1: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.4.1-3: Cell specific test parameters for FR2 PCell for CSI-RS-based beam failure detection and link recovery testing in DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
AoA setup			Setup 1 defined in A.3.15				
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_CSI-RS of set q_0	Config 1	dB	5	-3	-12	-12	-12
SNR_CSI-RS of set q_1	Config 1	dB	0.2	0.2	20.2	20.2	20.2
CSI-RS_RP of set q_1	Config 1	dBm/SCS kHz	-104.5	-104.5	-84.5	-84.5	-84.5
N_{oc}	Config 1	dBm/120 KHz	-104.7				
Propagation condition			TDL-A 30ns 75Hz				

Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1.
Note 4: Void
Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1.
Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG.
Note 7: SNR levels correspond to the signal to noise ratio over the REs carrying CSI-RS.
Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.4.1-1.
Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6.
Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

Table A.7.5.5.4.1-4: Void

Table A.7.5.5.4.1-5: Void

Table A.7.5.5.4.1-6: Void

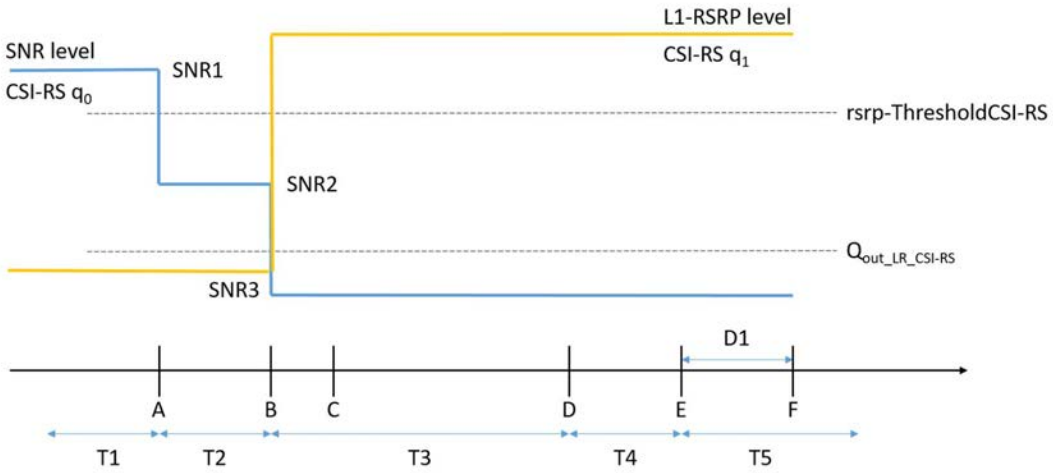


Figure A.7.5.5.4.1-1: SNR and L1-RSRP variation for CSI-RS-based beam failure detection and link recovery testing in DRX mode

A.7.5.5.4.2 Test Requirements

The UE behaviour during time durations T1, T2, T3, T4 and T5 shall be as follows:

During the time duration T1 and T2, the UE shall transmit uplink signal at least in all subframes configured for CSI transmission on Cell 1.

During the period from time point A to time point B the UE shall transmit uplink signal in Cell 1 in all uplink slots configured for CSI transmission according to the configured periodic CSI reporting for Cell 1.

During T3 the UE shall detect beam failure and initiat link recovery. During T4 and T5 the UE measures and evaluate beam candidate from beam candidate set q_1.

No later than time point F occurring no later than D1 = 260+10 ms after the start of T5, the UE shall transmit preamble on a beam associated with the candidate beam set q_1. The UE shall not transmit preamble on a beam associated with the candidate beam set q_1 earlier than time point B.

Test is concluded once the test equipment has received the initial preamble transmission from the UE. The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.5.5 Scheduling availability restriction during Beam Failure Detection and Link Recovery for FR2 PCell configured with SSB-based BFD and LR in non-DRX mode

A.7.5.5.5.1 Test Purpose and Environment

The purpose is to test scheduling availability restrictions when the UE is performing beam failure detection or when the UE is performing L1-RSRP measurement for candidate beam detection, when no DRX is used. This test will verify the scheduling availability restriction requirements in clause 8.5.7 and 8.5.8.

The test parameters are given in Tables A.7.5.5.5.1-1, A.7.5.5.5.1-2 and A.7.5.5.5.1-3 below. There is one cell, cell 1 which is the active cell, in the test. The test consists of five successive time periods, with time duration of T1, T2, T3, T4 and T5 respectively. Figure A.7.5.5.5.1-1 shows the variation of the downlink SNR of the SSB in set q_0 in the active cell to emulate SSB based beam failure. Figure A.7.5.5.5.1-1 additionally shows the variation of the downlink L1-RSRP of the SSB in set q_1 of the candidate beam used for link recovery. Prior to the start of the time duration T1, the UE shall be fully synchronized to cell 1. The UE shall be configured for periodic CSI reporting with a reporting periodicity defined in CSI-RS configuration. This test will focus on the scheduling availability during beam failure detection) and candidate beam detection. In the test, DRX configuration is not enabled. Test is to test the scheduling availability restriction of UE performing beam failure detection and candidate beam detection when SSB RS configured for Beam failure detection and candidate beam detection. During the test the UE is scheduled to transmit continuously in UL.

Table A.7.5.5.5.1-1: Supported test configurations for FR2 PCell

Configuration	Description
1	NR 120 kHz SSB SCS, 100MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.5.5.1-2: General test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Value	Comment
			Test 1	
Active PCell			Cell 1	
RF Channel Number			1	
Duplex mode	Config 1		TDD	
TDD Configuration	Config 1		TDDConf.3.1	
DL initial BWP configuration	Config 1		DLBWP.0.1	
DL dedicated BWP configuration	Config 1		DLBWP.1.1	
UL initial BWP configuration	Config 1		ULBWP.0.1	
UL dedicated BWP configuration	Config 1		ULBWP.1.1	
CORESET Reference Channel	Config 1		CR. 3.1 TDD	
SSB Configuration	Config 1		SSB.1 FR2	
SMTC Configuration	Config 1		SMTC.1	
PDSCH/PDCCH subcarrier spacing	Config 1		120 KHz	
SSB index assigned as BFD RS (q_0)			0	
SSB index assigned as CBD RS (q_1)			1	
TRS configuration			TRS.2.1 TDD	
TCI configuration			TCI.State.0	
OCNG parameters			OP.1	
AoA Setup			Setup 1	A.3.15.1
CP length			Normal	
Beam failure detection transmission parameters	DCI format		1-0	
	Number of Control OFDM symbols		2	
	Aggregation level	CCE	8	
	Ratio of hypothetical PDCCH RE energy to average CSI-RS RE energy	dB	0	
	Ratio of hypothetical PDCCH DMRS energy to average CSI-RS RE energy	dB	0	
	DMRS precoder granularity		REG bundle size	
	REG bundle size		6	
DRX			OFF	DRX is not in use
Gap pattern ID			N.A.	No measurement gap pattern is configured
ssb-Index			2	Number of SSB indexes used for beam failure detection
rlmInSyncOutOfSyncThreshold			absent	When the field is absent, the UE applies the 10%
rsrp-ThresholdSSB		dBm/SCS kHz	-94.5	Threshold used for $Q_{in\_LR\_SSB}$
powerControlOffsetSS			db0	Used for deriving rsrp-ThresholdCSI-RS
beamFailureInstanceMaxCount			n1	see TS 38.321 [7], clause 5.17

beamFailureDetectionTimer			pbfd4	see TS 38.321 [7], clause 5.17
CSI Configuration for reporting	Config 1		CSI-RS.3.1 TDD	A.3.14.2
T310 Timer		ms	1000	
N310			2	
T1		s	1	During this time the the UE shall be fully synchronized to cell 1
T2		s	2.6	
T3		s	1.64	
T4		s	0	
T5		s	1.01	
D1		s	0.97	
Note 1: All configurations are assigned to the UE prior to the start of time period T1. Note 2: UE-specific PDCCH is not transmitted after T1 starts.				

Table A.7.5.5.5.1-3: Cell specific test parameters for FR2 PCell for SSB-based beam failure detection and link recovery testing in non-DRX mode

Parameter		Unit	Test 1				
			T1	T2	T3	T4	T5
Assumption for UE beams Note 10			Rough				
EPRE ratio of PDCCH DMRS to SSS		dB	0				
EPRE ratio of PDCCH to PDCCH DMRS		dB					
EPRE ratio of PBCH DMRS to SSS		dB					
EPRE ratio of PBCH to PBCH DMRS		dB					
EPRE ratio of PSS to SSS		dB					
EPRE ratio of PDSCH DMRS to SSS		dB					
EPRE ratio of PDSCH to PDSCH DMRS		dB					
EPRE ratio of OCNG DMRS to SSS		dB					
EPRE ratio of OCNG to OCNG DMRS		dB					
SNR_SSB of set q_0	Config 1	dB	5	-3	-12	-12	-12
SSB_RP of set q_1	Config 1	dBm/SCS kHz	-104.5	-104.5	-84.5	-84.5	-84.5
SNR_SSB of set q_1	Config 1	dB	-12	-12	5	5	5
N_{oc}	Config 1	dBm/15 KHz	-104.7				
Propagation condition			TDL-A 30ns 75Hz				
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: The uplink resources for CSI reporting are assigned to the UE prior to the start of time period T1. Note 3: NZP CSI-RS resource set configuration for CSI reporting are assigned to the UE prior to the start of time period T1. Note 4: Void Note 5: The timers and layer 3 filtering related parameters are configured prior to the start of time period T1. Note 6: The signal contains PDCCH for UEs other than the device under test as part of OCNG. Note 7: SNR levels correspond to the signal to noise ratio over the SSS REs. Note 8: The SNR in time periods T1, T2, T3, T4 and T5 is denoted as SNR1, SNR2 and SNR3 respectively in figure A.7.5.5.5.1-1. Note 9: The SNR values are specified for testing a UE which supports 2RX on at least one band. For testing of a UE which supports 4RX on all bands, the SNR during T3 is modified as specified in clause A.3.6. Note 10: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.							

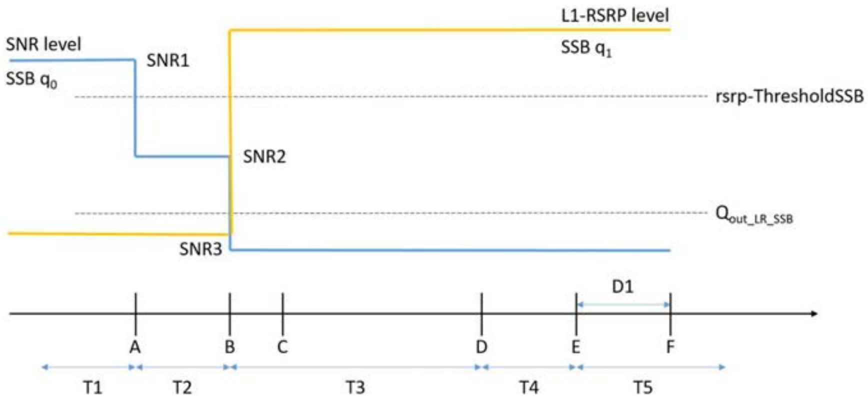


Figure A.7.5.5.5.1-1: SNR and L1-RSRP variation SSB for SSB-based beam failure detection and link recovery testing in non-DRX mode

A.7.5.5.5.2 Test Requirements

The UE behaviour during time duration T3 follows the requirements defined in clause 8.5.7.3:

- The UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/CSI-RS for tracking/CSI-RS for CQI on BFD-RS symbols to be measured for beam failure detection.

The UE behaviour during time durations T4 and T5 follows the requirements defined in clause 8.5.8.3:

- The UE is not expected to transmit PUCCH/PUSCH or receive PDCCH/PDSCH on reference symbols to be measured for candidate beam detection.

A.7.5.6 Active BWP switch

A.7.5.6.1 DCI-based and Timer-based Active BWP Switch

A.7.5.6.1.1 NR FR2- NR FR2 DL active BWP switch of PCell with non-DRX in SA

A.7.5.6.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

The supported test configurations are shown in Table A.7.5.6.1.1.1-1 below. The test scenario comprises of one PCell (Cell 1) and one SCell (Cell 2) as given in Table A.7.5.6.1.1.1-2. NR Cell-specific parameters are specified in Table A.7.5.6.1.1.1-3 below. OTA related test parameters are shown in table A.7.5.6.1.1.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 1 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).

UE is configured with 2 different UE-specific downlink bandwidth parts for PCell, BWP-1 and BWP-2, in Cell 1 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.

UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for SCell, BWP-0 in Cell 2 before starting the test.

UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1 in PCell.

UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-0 in SCell.

UE is configured with a bwp-InactivityTimer timer value for PCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of PCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PCell no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-2 no later than the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch on PCell shall occur within the BWP switch delay.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PCell(Cell 1).

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the half subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of PCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PCell at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-1 no later than the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch of PCell shall occur within the BWP switch delay.

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The test equipment verifies that potential interruption to SCell is carried out in the correct time span by monitoring ACK/NACK sent in SCell during BWP switch of PCell, respectively.

Table A.7.5.6.1.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD -TDD duplex mode
Note 1: Void	

Table A.7.5.6.1.1.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1, 2	Two NR radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and SCell
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	µs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.7.5.6.1.1.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Cell 1	Cell2
Frequency Range		FR2	FR2
Duplex mode		TDD	
TDD configuration		TDDConf.3.1	
$BW_{channel}$		100 MHz: $N_{RB,c}$ = 66	
Active BWP ID		1, 2	0
Downlink initial BWP Configuration		DLBWP.0.2	
Uplink initial BWP Configuration		ULBWP.0.2	
Downlink active BWP-0 Configuration		-	DLBWP.0.2
Downlink active BWP-1 Configuration		DLBWP.1.1	-
Downlink active BWP-2 Configuration		DLBWP.1.3	-
Uplink active BWP-0 Configuration		-	ULBWP.0.2
Uplink active BWP-1 Configuration		ULBWP.1.1	-
Uplink active BWP-2 Configuration		ULBWP.1.3	-
PDSCH Reference measurement channel		SR.3.1 TDD	
TRS configuration		TRS.2.1 TDD	
TCI state		TCI.State.0	
RMSI CORESET parameters		CR.3.1 TDD	
Dedicated CORESET parameters		CCR.3.1 TDD	
OCNG Patterns		OP.1	
SSB Configuration		SSB.1 FR2	
SMTC Configuration		SMTC.1	
Correlation Matrix and Antenna Configuration		1x2 Low	
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Propagation Condition		AWGN	AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.5.6.1.1.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 defined in clause A.3.15.1	Angle of arrival configuration
Assumtion for UE beams Note 6		Fine	Fine
N_{oc} Note1	dBm/15kHz	-112	-112
N_{oc} Note1	dBm/SCS	-103	-103
SS-RSRP Note2	dBm/SCS Note3	-85	-85
$\hat{E}_s/I_{ot}$	dB	18	18
Io Note4	dBm/95.04 MHz Note4	-56	-56
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone. Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.			

A.7.5.6.1.1.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot (i+$T_{BWPswitchDelay}$+$k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot (j+$T_{BWPswitchDelay}$+$k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

During T1 and T3, the start time of SCell interruption during PCell active BWP switch shall not happen outside the BWP switch delay.

The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.2.2.2.5.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK in the first UL slot that occurs after the beginning of DL slot (i+ $T_{BWPswitchDelay}$+$k1$), (j+ $T_{BWPswitchDelay}$+$k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK.

A.7.5.6.1.2 NR FR1- NR FR2 DL active BWP switch of PCell with non-DRX in SA

A.7.5.6.1.2.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6, and interruption requirement on other active serving cell defined in clause 8.2.2.2.5.

The supported test configurations are shown in Table A.7.5.6.1.2.1-1 below. The test scenario comprises of one NR PCell (Cell 1) and one NR SCell (Cell 2). The general parameters are given in Table A.7.5.6.1.2.1-2. NR Cell-specific parameters are specified in Table A.7.5.6.1.2.1-3 below. OTA related test parameters are shown in table A.7.5.6.1.2.1-4 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE would have ACK/NACK sending except for the time duration when BWP is switching on Cell 1 and the time duration of T2.

PDCCHs indicating new transmissions shall be sent continuously on SCell (Cell 2) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

UE is connected to Cell 1 (PCell) on radio channel 1 (PCC), and Cell 2 (SCell) on radio channel 2 (SCC).

UE is configured with 2 different UE-specific downlink bandwidth parts for PCell, BWP-1 and BWP-2, in Cell 1 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.

- UE is configured with 1 UE-specific downlink bandwidth parts the same as initial BWP for SCell, BWP-0 in Cell 2 before starting the test.

UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-1 in PCell.

- UE is indicated in firstActiveDownlinkBWP-Id that the active DL BWP is BWP-0 in SCell.

UE is configured with a bwp-InactivityTimer timer value for PCell.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for PCell DL BWP switch, sent from the test equipment to the UE, is received at the UE side in PCell's slot # denoted *i*. The UE shall switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of PCell's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PCell no later than the first UL slot that occurs after the begining of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-2 no later than the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch on PCell shall occur within the BWP switch delay if the UE doesn't support per-FR gap, otherwise no interruption due to BWP switch on SCell is allowed.

During T2, the test equipment won't transmit DCI format for PDSCH reception on PCell(Cell 1).

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the half subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH no later than the first DL slot that occurs after the beginning of PCell's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the PCell at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on PCell's BWP-1 no later than the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The starting time of SCell (Cell 2) interruption due to BWP switch of PCell shall occur within the BWP switch delay if the UE doesn't support per-FR gap, otherwise no interruption due to BWP switch on SCell is allowed.

The test equipment verifies the DL BWP switch time in PCell by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK/NACK is received.

The test equipment verifies that potential interruption to SCell is carried out in the correct time span by monitoring ACK/NACK sent in SCell during BWP switch of PCell, respectively.

Table A.7.5.6.1.2.1-1: DL BWP switch supported test configurations

Config	Description
1	PCell: NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode SCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	PCell: NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode SCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
3	PCell: NR 30 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode SCell: NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.6.1.2.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		2	Two NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
Active SCell		Cell 2	SCell on RF channel number 2.
CP length		Normal	
DRX		OFF	For both PCell and SCell
bwp-InactivityTimer	ms	200	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
Cell-individual offset for cells on RF channel number 2	dB	0	Individual offset for cells on PSCC.
Cell2 timing offset to cell1	µs	3	Time alignment error as specified in TS 38.104 [13] clause 6.5.3.1.
T1	s	0.2	
T2	s	0.2	
T3	s	0.2	

Table A.7.5.6.1.2.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter		Unit	Cell 1	Cell2
Frequency Range			FR1	FR2
Duplex mode	Config 1		FDD	TDD
	Config 2,3		TDD	
TDD configuration	Config 1		Not Applicable	TDDConf.3.1
	Config 2		TDDConf.1.1	
	Config 3		TDDConf.2.1	
$BW_{channel}$	Config 1,2	MHz	10 MHz: $N_{RB,c}$ = 52	100 MHz: $N_{RB,c}$ = 66
	Config 3		40 MHz: $N_{RB,c}$ = 106	
Active BWP ID			1, 2	0
Downlink initial BWP Configuration			DLBWP.0.2	
Uplink initial BWP Configuration			ULBWP.0.2	
Downlink active BWP-0 Configuration			-	DLBWP.0.2
Downlink active BWP-1 Configuration			DLBWP.1.1	-
Downlink active BWP-2 Configuration			DLBWP.1.3	-
Uplink active BWP-0 Configuration			-	ULBWP.0.2
Uplink active BWP-1 Configuration			ULBWP.1.1	-
Uplink active BWP-2 Configuration			ULBWP.1.3	-
PDSCH Reference measurement channel	Config 1		SR.1.1 FDD	SR.3.1 TDD
	Config 2		SR.1.1 TDD	
	Config 3		SR.2.1 TDD	
RMSI CORESET parameters	Config 1		CR.1.1 FDD	CR.3.1 TDD
	Config 2		CR.1.1 TDD	
	Config 3		CR.2.1 TDD	
Dedicated CORESET parameters	Config 1		CCR.1.1 FDD	CCR.3.1 TDD
	Config 2		CCR.1.1 TDD	
	Config 3		CCR.2.1 TDD	
OCNG Patterns			OP.1	
SSB Configuration	Config 1,2		SSB.1 FR1	SSB.1 FR2
	Config 3		SSB.2 FR1	
TRS configuration	Config 1,2,3		-	TRS.2.1 TDD
TCI state	Config 1,2,3		TCI.State.0	TCI.State.0
SMTC Configuration			SMTC.1	
Correlation Matrix and Antenna Configuration			NA Link only, see clause A.3.7A	1x2 Low
EPRE ratio of PSS to SSS		dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS(Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
Propagation Condition			NA Link only, see clause A.3.7A	AWGN

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and SCH_RP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.7.5.6.1.2.1-4: OTA related test parameters for BWP switching test case

Parameter	Unit	Cell 1	Cell 2
Angle of arrival configuration		-NA Link only, see clause A.3.7A	Setup 1 defined in clause A.3.15.1
Assumption for UE beams Note 6			Fine
N_{oc} Note1	dBm/15kHz		-112
N_{oc} Note1	dBm/SCS		-103
SS-RSRP Note2	dBm/SCS Note3		-85
$\hat{E}_s/I_{ot}$	dB		18
Io Note4	dBm/95.04 MHz Note4		-56
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone. Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.			

A.7.5.6.1.2.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

If the UE doesn't support per-FR gap,

- During T1 and T3, the start time of SCell interruption during PCell active BWP switch shall not happen outside the BWP switch delay.

- The interruption of SCell shall not be longer than the interruption duration specified for active BWP switch in clause 8.2.2.2.5.

Otherwise no interruption due to BWP switch on SCell is allowed.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch interruption to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after the beginning of DL slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.7.5.6.1.3 NR FR2 DL active BWP switch with non-DRX in SA

A.7.5.6.1.3.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement defined in clause 8.6. Supported test configurations are shown in Table A.7.5.6.1.3.1-1.

The test scenario comprises of one cell (Cell 1) as given in Table A.7.5.6.1.3.1-2. Cell-specific parameters of NR PCell is specified in Table A.7.5.6.1.3.1-3 below. The OTA related test parameters for FR2 is shown in Table A.7.5.6.1.3.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 on radio channel 1.
- UE is configured with 2 different UE-specific downlink bandwidth parts, BWP-1 and BWP-2 before starting the test. BWP-1 and BWP-2 always include bandwidth of the initial DL BWP and SSB.
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1.
- UE is configured with a *bwp-InactivityTimer* timer value for Cell1.

All cells have constant signal levels throughout the test.

The test consists of 3 successive time periods, with durations of T1, T2, and T3, respectively.

During T1,

Time period T1 starts when a DCI format 1_1 command for DL BWP switch, sent from the test equipment to the UE, is received at the UE side in Cell 1's slot # denoted *i*. The UE should switch its bandwidth part from BWP-1 to BWP-2.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($i+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 no later than the first UL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-2 starting from the first DL slot that occurs after the beginning of slot ($i+T_{BWPswitchDelay}$).

During T2, the test equipment won't transmit DCI format for PDSCH reception on Cell 1.

During T3,

The time period T3 starts from the slot #*j*, where j is the first slot of the half subframe immediately after *bwp-InactivityTimer* timer expires. The UE should switch its bandwidth part from BWP-2 back to the default bandwidth part – BWP-1.

The UE shall be able to receive PDSCH on the first DL slot that occurs after the beginning of Cell 1's DL slot ($j+T_{BWPswitchDelay}$) as defined in clause 8.6 and starts to report valid ACK/NACK for the Cell 1 at latest on the first UL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}+k1$). The UE shall be continuously scheduled on Cell 1's BWP-1 starting from the first DL slot that occurs after the beginning of slot ($j+T_{BWPswitchDelay}$).

The test equipment verifies the DL BWP switch time by counting the slots from the time when the BWP switch command is received or *bwp-InactivityTimer* timer expires till an ACK is received.

Table A.7.5.6.1.3.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: Void. Note 2: A UE which fulfils the requirements in test case A.7.5.6.1.1 or A.7.5.6.1.2 can skip the test cases in A.7.5.6.1.3.	

Table A.7.5.6.1.3.1-2: General test parameters for DL BWP switch in SA

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active Cell		Cell 1	Cell on RF channel number 1.
CP length		Normal	
DRX		OFF	For both PCell and PSCell
bwp-InactivityTimer	ms	[200]	
T1	s	[0.2]	
T2	s	[0.2]	
T3	s	[0.2]	

Table A.7.5.6.1.3.1-3: NR Cell specific test parameters for DL BWP switch in SA

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{RB,c}$ = 66
Active BWP ID		1, 2
Initial DL BWP Configuration		DLBWP.0.2 Note 2
Active DL BWP-1 Configuration		DLBWP.1.1 Note 2
Active DL BWP-2 Configuration		DLBWP.1.3 Note 2
Initial UL BWP Configuration		ULBWP.0.2 Note 2
Active UL BWP-1 Configuration		ULBWP.1.1 Note 2
Active UL BWP-2 Configuration		ULBWP.1.3 Note 2
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State		TCI.State.0
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].		

Table A.7.5.6.1.3.1-4: OTA related test parameters for DL BWP switch in SA

Parameter	Unit	Cell 2
Angle of arrival configuration		Setup 1 defined in clause A.3.15.1
Assumption for UE beams Note 6		Fine
N_{oc} Note 1	dBm/15 kHz	-112
N_{oc} Note 1	dBm/SCS	-103
SS-RSRP Note 2	dBm/120 kHz Note3	-85
$\hat{E}_s/I_{ot}$	dB	18
$\hat{E}_s/N_{oc}$ Note 5	dB	18
Io Note2	dBm/95.04 MHz Note4	-56
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone. Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.		

A.7.5.6.1.3.2 Test Requirements

During T1, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($i+T_{BWPswitchDelay}+k1$).

During T3, the UE shall start to send the ACK/NACK for PCell from the first UL slot that occurs after the beginning of DL slot ($j+T_{BWPswitchDelay}+k1$).

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

Depending on UE capability *bwp-SwitchingDelay* [2], UE shall finish BWP switch within the time duration $T_{BWPswitchDelay}$ defined in Table 8.6.2-1.

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: During T1, T3 if there are no uplink resources for reporting the ACK/NACK in the first UL slot that occurs after the beginning of DL slot ($i+ T_{BWPswitchDelay}+k1$), ($j+ T_{BWPswitchDelay}+k1$), then the UE shall use the next available uplink resource for reporting the corresponding ACK/NACK.

A.7.5.6.2 RRC-based Active BWP Switch

A.7.5.6.2.1 NR FR2 DL active BWP switch of PCell with non-DRX in SA

A.7.5.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the DL BWP switch delay requirement for RRC-based BWP switch defined in clause 8.6.3. Supported test configurations are shown in Table A.7.5.6.2.1.1-1.

The test scenario comprises of one PCell (Cell 1) as given in Table A.7.5.6.2.1.1-2. Cell-specific parameters of PCell are specified in Table A.7.5.6.2.1.1-3 below.

PDCCHs indicating new transmissions shall be sent continuously on PCell (Cell 1) to ensure that the UE will have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE has bandwidth part BWP-1 in its RRC-configuration for Cell 1 (PCell).
- UE is indicated in *firstActiveDownlinkBWP-Id* that the active DL BWP is BWP-1 of initial condition in PCell.

All cells have constant signal levels throughout the test.

The test consists of 1 time period, with duration of T1.

During T1,

Time period T1 starts when a *RRCReconfiguration* with updated bandwidth part configuration, sent from the test equipment to the UE, is received at the UE side in PSCell's slot # denoted *i*. The UE shall reconfigure its bandwidth part with the updated bandwidth part BWP-1 of final condition.

The UE shall be able to completely receive PDSCH on PCell from the first DL slot that occurs after the beginning of DL slot $\mathrm{i} + \frac{T_{\mathrm{RRCprocessingDelay}} + T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$ as defined in clause 8.6.3 and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot $\mathrm{i} + \frac{T_{\mathrm{RRCprocessingDelay}} + T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}} + \mathrm{k1}$. The UE shall be continuously scheduled on PSCell's BWP-1 starting from the first DL slot that occurs after the beginning of DL slot $\mathrm{i} + \frac{T_{\mathrm{RRCprocessingDelay}} + T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$.

$T_{RRCprocessingDelay}$ and $T_{BWPswitchDelayRRC}$ are defined in clause 8.6.3.

The test equipment verifies the DL BWP switch time in PSCell by counting the time from the time when the RRC Reconfiguration message including updated BWP configurationis sent till the time when RRC Reconfiguration Complete message is received.

Table A.7.5.6.2.1.1-1: DL BWP switch supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.6.2.1.1-2: General test parameters for DL BWP switch in synchronous EN-DC

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
Cell-individual offset for cells on RF channel number 1	dB	0	Individual offset for cells on PCC.
T1	s	[0.2]	

Table A.7.5.6.2.1.1-3: NR Cell specific test parameters for DL BWP switch in synchronous EN-DC

Parameter		Unit	Cell 1
Frequency Range			FR2
Duplex mode			TDD
TDD configuration			TDDConf.3.1
$BW_{channel}$			100 MHz: $N_{RB,c}$ = 66
Active BWP ID			1
Initial Condition	Active DL BWP-1 Configuration		DLBWP.0.2
	Active UL BWP-1 Configuration		ULBWP.1.3
Final Condition	Active DL BWP-1 Configuration		DLBWP.1.1
	Active UL BWP-1 Configuration		ULBWP.1.1
'PDSCH Reference measurement channel			SR.3.1 TDD
RMSI CORESET parameters			CR.3.1 TDD
Dedicated CORESET parameters			CCR.3.1 TDD
OCNG Patterns			OP.1
SSB Configuration			SSB.1 FR2
SMTC Configuration			SMTC.1
TCI State			TCI.State.0
TRS Configuration			TRS.2.1 TDD
Antenna Configuration			1x2
Propagation Condition			AWGN
EPRE ratio of PSS to SSS		dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH			
EPRE ratio of OCNG DMRS to SSS(Note 1)			
EPRE ratio of OCNG to OCNG DMRS (Note 1)			
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: For unpaired spectrum, a DL BWP is linked with an UL BWP. DLBWP.0.2 is linked with ULBWP.0.2; DLBWP.1.1 is linked with ULBWP.1.1; DLBWP.1.3 is linked with ULBWP.1.3 defined in clause 12 of TS 38.213 [3].			

Table A.7.5.6.2.1.1-4: OTA related test parameters for BWP switching test case

Parameter		Unit	Cell 2
Angle of arrival configuration			Setup 1 according to table A.3.15
Assumption for UE beams Note 5			Fine
N_{oc} Note1	NR_TDD_FR2_A	dBm/15kHz	-112
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
N_{oc} Note1	NR_TDD_FR2_A	dBm/SCS	-103
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
SS-RSRP Note2	NR_TDD_FR2_A	dBm/SCS Note3	-85
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		
$\hat{E}_s/I_{ot}$		dB	18
Io Note2	NR_TDD_FR2_A	dBm/95.04 MHz Note4	-56
	NR_TDD_FR2_B		
	NR_TDD_FR2_F		
	NR_TDD_FR2_G		
	NR_TDD_FR2_T		
	NR_TDD_FR2_Y		

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

Note 5: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.6.2.1.2 Test Requirements

During T1, the UE shall be ready for the reception of uplink grant for PCell from the first DL slot that occurs after the beginning of slot $\mathrm{i} + \frac{T_{\mathrm{RRCprocessingDelay}} + T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}}$ and starts to report valid ACK/NACK for the PCell from the first UL slot that occurs after the beginning of DL slot $\mathrm{i} + \frac{T_{\mathrm{RRCprocessingDelay}} + T_{\mathrm{BWPswitchDelayRRC}}}{\mathrm{NR\ Slot\ length}} + \mathrm{k1}$.

Where, *k1* is the timing between DL data receiving and acknowledgement as specified in [7].

All of the above test requirements shall be fulfilled in order for the observed PCell active BWP switch delay to be counted as correct.

The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.7 PSCell addition and release delay

A.7.5.7.1 Addition and Release Delay of known NR PSCell

A.7.5.7.1.1 Test Purpose and Environment

The purpose of this test is to verify the PSCell addition and release delay requirements defined in clauses 8.9.2 and 8.9.3, respectively, for the case where the PSCell is known to the UE at the time of addition.

The supported test configurations are given in Table A.7.5.7.1.1-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 in FR1 and radio channel 2 in FR2, respectively. Test parameters are given in Tables A.7.5.7.1.1-2 and A.7.5.7.1.1-3 below. The test consists of five time periods with durations T1, T2, T3, T4 and T5, respectively.

At the start of T1, the UE shall be connected to Cell 1 (PCell) on radio channel 1 (PCC) and shall only monitor PCC and hence be unaware of Cell 2 (PSCell-to-be) on radio channel 2. Before the start of T2, the test system shall send measurement control information including measurement gap configuration and event-triggered reporting configuration for measurements on radio channel 2.

During T2, the UE shall identify Cell 2 and send an event-triggered report. When the tests system receives the report, it shall send updated measurement control information where the measurement gap pattern is released. Before the start of T3, the test system shall send a RRC message instructing the UE to add PSCell (Cell 2), and further instructing the UE to report CSI periodically in the PSCell once it has been added. Reception by the UE of this RRC message defines the start of T3.

During T3, the UE shall carry out random access towards the PSCell. Reception by the test system of the PRACH preamble defines the start of T4.

During T4, the UE shall send periodic CSI reports in PSCell. After having received at least one such report, the test system shall send a RRC message instructing the UE to release the PSCell. Reception by the UE of the RRC message defines the start of T5.

During T5, the UE shall release the PSCell.

Table A.7.5.7.1.1-1: Supported test configurations for FR2 PSCell

Config	Description
1	FR1 FDD SSB SCS 15kHz BW 10MHz – FR2 TDD SSB SCS 240kHz BW 100MHz
2	FR1 TDD SSB SCS 15kHz BW 10MHz – FR2 TDD SSB SCS 240kHz BW 100MHz
3	FR1 TDD SSB SCS 30kHz BW 40MHz – FR2 TDD SSB SCS 240kHz BW 100MHz
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.7.1.1-2: General test parameters for PSCell addition and release delay

Parameter		Unit	Value	Comment
RF Channel Number			1, 2	Two radio channels are used for this test
Active PCell			Cell 1	PCell on RF channel number 1 in FR1
Neighbour cell			Cell 2	Neighbour cell (PSCell-to-be) on RF channel number 2 in FR2
A4	Hysteresis	dB	0	Hysteresis for event A4
	Threshold RSRP	dBm	-97	Threshold for event A4
	Time to Trigger	S	0	Time to trigger for event A4
DRX			OFF	For both PCell and PSCell once activated
Measurement gap pattern ID			0	Gaps are configured before T2 and released before T3.
PRACH configuration in Cell 2			FR2 PRACH configuration 2	PRACH configuration as specified in Clause A.3.8.3.2.
CSI reporting periodicity and offset configuration for Cell 2		ms	2	
T1		s	5	During this time the PCell is known and Cell 2 is unknown.
T2		s	1	During this time the UE shall identify neighbour cell 2 and report event B1.
T3		s	1	During this time the UE adds the PSCell.
T4		s	1	During this time the UE sends CSI reports for PSCell.
T5		s	1	During this time the UE releases the PSCell.

Table A.7.5.7.1.1-3: NR Cell specific test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell2				
				T1	**T2**	**T3**	**T4**	**T5**
AoA setup		1,2,3	N/A	Setup 2a according to clause A.3.15.2.1				
Assumption for UE beams [Note 5]			N/A	Rough				
Frequency Range		1,2,3	FR1	FR2				
Duplex mode		1	FDD	TDD				
		2,3	TDD					
TDD configuration		1	–	TDDConf.3.1				
		2	TDDConf.1.1					
		3	TDDConf.2.1					
$BW_{channel}$	MHz	1,2	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66				
		3	40: $N_{RB,c}$ = 106					
Initial Downlink BWP configuration		1,2,3	DLBWP.0.1	DLBWP.0.1				
Initial Uplink BWP configuration		1,2,3	ULBWP.0.1	ULBWP.0.1				
Dedicated Downlink BWP configuration		1,2,3	DLBWP.1.1	DLBWP.1.1				
Dedicated Uplink BWP configuration		1,2,3	ULBWP.1.1	ULBWP.1.1				
PDSCH Reference Measurement Channel		1	SR.1.1 FDD	SR.3.1 TDD				
		2	SR.1.1 TDD					
		3	SR.2.1 TDD					
TRS configuration		1,2,3	–	TRS.2.1 TDD				
TCI state		1,2,3	–	TCI.State.0				
RMSI CORESET parameters		1	CR.1.1 FDD	CR.3.1 TDD				
		2	CR.1.1 TDD					
		3	CR.2.1 TDD					
Dedicated CORESET parameters		1	CCR.1.1 FDD	CCR.3.1 TDD				
		2	CCR.1.1 TDD					
		3	CCR.2.1 TDD					
OCNG Patterns [Note1]		1,2,3	OP.1	OP.1				
SSB configuration		1,2	SSB.1 FR1	SSB.2 FR2				
		3	SSB.2 FR1					
SMTC configuration		1,2,3	SMTC.2	SMTC.1				
Correlation Matrix and Antenna config		1,2,3	1x2 Low	1x2 Low				
EPRE ratio of PSS to SSS	dB	1,2,3	0	0				
EPRE ratio of PBCH DMRS to SSS								
EPRE ratio of PBCH to PBCH DMRS								
EPRE ratio of PDCCH DMRS to SSS								
EPRE ratio of PDCCH to PDCCH DMRS								
EPRE ratio of PDSCH DMRS to SSS								
EPRE ratio of PDSCH to PDSCH								
EPRE ratio of OCNG DMRS to SSS								
EPRE ratio of OCNG to OCNG DMRS								
N_{oc} [Note2]	dBm/ 15kHz	1,2,3	-98	N/A	-98			
N_{oc} [Note2]	dBm/SCS	1,2	-98	N/A	-89			
		3	-95					
$\hat{E}_s/I_{ot}$	dB	1,2,3	5	$-\infty$	5			
$\hat{E}_s/N_{oc}$	dB	1,2,3	5	$-\infty$	5			
SS-RSRP [Note3,4]	dBm/SCS	1,2	-93	N/A	-84			
		3	-90					
Io [Note3,4]	dBm/ 9.36 MHz	1,2	-63.85	–	–			
	dBm/ 38.16 MHz	3	-57.76	–	–			
	dBm/ 95.04 MHz	1,2,3	–	N/A	-53.82			
Propagation Condition		1,2,3	AWGN	AWGN				

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4:	Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.
Note 5:	Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.7.1.2 Test Requirements

The UE shall transmit the PRACH preamble to PSCell at latest 112 ms into T3.

The UE shall transmit at least one periodic CSI report for PSCell during T4.

The UE shall stop transmitting CSI reports for PSCell at latest 20 ms into T5.

All of the above test requirements shall be fulfilled in order for the observed PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.7.2 Addition and Release Delay of unknown NR PSCell

A.7.5.7.2.1 Test Purpose and Environment

The purpose of this test is to verify the PSCell addition and release delay requirements defined in clauses 8.9.2 and 8.9.3, respectively, for the case where the PSCell is unknown to the UE at the time of addition.

The supported test configurations are given in Table A.7.5.7.2.1-1. The test scenario comprises two NR cells, Cell 1 and Cell 2, on radio channel 1 in FR1 and radio channel 2 in FR2, respectively. Test parameters are given in Tables A.7.5.7.2.1-2 and A.7.5.7.2.1-3 below. The test consists of four time periods with durations T1, T2, T3 and T4, respectively.

At the start of T1, the UE shall be connected to Cell 1 (PCell) on radio channel 1 (PCC) and shall only monitor PCC and hence be unaware of Cell 2 (PSCell-to-be) on radio channel 2. At the end of T1, the test system shall send a RRC message instructing the UE to add PSCell (Cell 2), and further instructing the UE to report CSI periodically in the PSCell once it has been added. Reception by the UE of this RRC message defines the start of T2.

During T2, the UE shall identify PSCell and carry out random access towards the PSCell. Reception by the test system of the PRACH preamble defines the start of T3.

During T3, the UE shall send periodic CSI reports in PSCell. After having received at least one such report, the test system shall send a RRC message instructing the UE to release the PSCell. Reception by the UE of the RRC message defines the start of T4.

During T4, the UE shall release the PSCell.

Table A.7.5.7.2.1-1: Supported test configurations for FR2 PSCell

Config	Description
1	FR1 FDD SSB SCS 15kHz BW 10MHz – FR2 TDD SSB SCS 240kHz BW 100MHz
2	FR1 TDD SSB SCS 15kHz BW 10MHz – FR2 TDD SSB SCS 240kHz BW 100MHz
3	FR1 TDD SSB SCS 30kHz BW 40MHz – FR2 TDD SSB SCS 240kHz BW 100MHz
Note 1: The UE is only required to be tested in one of the supported test configurations	

Table A.7.5.7.2.1-2: General test parameters for PSCell addition and release delay

Parameter	Unit	Value	Comment
RF Channel Number		1, 2	Two radio channels are used for this test
Active PCell		Cell 1	PCell on RF channel number 1 in FR1
Neighbour cell		Cell 2	Neighbour cell (PSCell-to-be) on RF channel number 2 in FR2
DRX		OFF	For both PCell and PSCell once activated
PRACH configuration in Cell 2		FR2 PRACH configuration 2	PRACH configuration as specified in Clause A.3.8.3.2.
CSI reporting periodicity and offset configuration for Cell 2	ms	[2]	
T1	s	5	During this time the PCell is known and Cell 2 is unknown.
T2	s	1	During this time the UE adds the PSCell.
T3	s	1	During this time the UE sends CSI reports for PSCell.
T4	s	1	During this time the UE releases the PSCell.

Table A.7.5.7.2.1-3: NR Cell specific test parameters for PSCell addition and release delay

Parameter	Unit	Config	Cell 1	Cell2			
				T1	T2	T3	T4
AoA setup		1,2,3	N/A	Setup 2a according to clause A.3.15.2.1			
Assumption for UE beams Note 5			N/A	Rough			
Frequency Range		1,2,3	FR1	FR2			
Duplex mode		1	FDD	TDD			
		2,3	TDD				
TDD configuration		1	–	TDDConf.3.1			
		2	TDDConf.1.1				
		3	TDDConf.2.1				
$BW_{channel}$	MHz	1,2	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66			
		3	40: $N_{RB,c}$ = 106				
Initial Downlink BWP configuration		1,2,3	DLBWP.0.1	DLBWP.0.1			
Initial Uplink BWP configuration		1,2,3	ULBWP.0.1	ULBWP.0.1			
Dedicated Downlink BWP configuration		1,2,3	DLBWP.1.1	DLBWP.1.1			
Dedicated Uplink BWP configuration		1,2,3	ULBWP.1.1	ULBWP.1.1			
PDSCH Reference Measurement Channel		1	SR.1.1 FDD	SR.3.1 TDD			
		2	SR.1.1 TDD				
		3	SR.2.1 TDD				
TRS configuration		1,2,3	–	TRS.2.1 TDD			
TCI state		1,2,3	–	TCI.State.0			
RMSI CORESET parameters		1	CR.1.1 FDD	CR.3.1 TDD			
		2	CR.1.1 TDD				
		3	CR.2.1 TDD				
Dedicated CORESET parameters		1	CCR.1.1 FDD	CCR.3.1 TDD			
		2	CCR.1.1 TDD				
		3	CCR.2.1 TDD				
OCNG Patterns Note1		1,2,3	OP.1	OP.1			
SSB configuration		1,2	SSB.1 FR1	SSB.2 FR2			
		3	SSB.2 FR1				
SMTC configuration		1,2,3	SMTC.2	SMTC.1			
Correlation Matrix and Antenna config		1,2,3	1x2 Low	1x2 Low			
EPRE ratio of PSS to SSS	dB	1,2,3	0	0			
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS							
EPRE ratio of OCNG to OCNG DMRS							
N_{oc} Note2	dBm/15kHz	1,2,3	-98	N/A	-98		
N_{oc} Note2	dBm/SCS	1,2	-98	N/A	-89		
		3	-95				
$\hat{E}_s/I_{ot}$	dB	1,2,3	5	$-\infty$	5		
$\hat{E}_s/N_{oc}$	dB	1,2,3	5	$-\infty$	5		
SS-RSRP Note3,4	dBm/SCS	1,2	-93	N/A	-84		
		3	-90				
Io Note3,4	dBm/9.36 MHz	1,2	-63.85	–	–		
	dBm/38.16 MHz	3	-57.76	–	–		
	dBm/95.04 MHz	1,2,3	–	N/A	-53.82		
Propagation Condition		1,2,3	AWGN	AWGN			

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4:	Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.
Note 5:	Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.7.2.2 Test Requirements

The UE shall transmit the PRACH preamble to PSCell at latest 572 ms into T2.

The UE shall transmit at least one periodic CSI report for PSCell during T3.

The UE shall stop transmitting CSI reports for PSCell at latest 20 ms into T4.

All of the above test requirements shall be fulfilled in order for the observed PSCell addition and release delay to be counted as correct. The rate of correct events observed during repeated tests shall be at least 90%.

A.7.5.8 Active TCI state switch delay

A.7.5.8.1 MAC-CE based active TCI state switch

A.7.5.8.1.1 NR PCell FR2 active TCI state switch for a known TCI state

A.7.5.8.1.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3. Supported test configuration is shown in Table A.7.5.8.1.1.1-1.

The test scenario comprises of one NR PCell (Cell 1) as given in Table A.7.5.8.1.1.1-2. Cell-specific parameters of NR PCell are specified in Table A.7.5.8.1.1.1-3 below. The OTA related test parameters for FR2 are shown in Table A.7.5.8.1.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).
- UE is configured with 2 different TCI states for PCell, PDCCH TCI state 0 (QCL'd to SSB0) and TCIstate 1 (QCL'd to SSB1), in Cell 1 before starting the test.
- UE is indicated in TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. During T1 only SSB to which PDCCH-TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state.

The test equipment verifies that UE can be scheduled on PCell on TCI state 0 till n+ T_{HARQ} +3 ms. The test equipment also verifies the TCI state switch time in PCell by scheduling the UE on TCI state 1 after n+ T_{HARQ} +3 ms + ($T_{first\text{-}SSB}$ + $T_{SSB\text{-}proc}$).

Table A.7.5.8.1.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.8.1.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	
T2	s	0.2	

Table A.7.5.8.1.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{RB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI.State.0
TCI State 1		TCI.State.1
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.8.1.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
N_{oc} Note 1	dBm/15 kHz	-92.1			
N_{oc} Note 1	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1	1	-Infinity	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1	-82.1	-Infinity	-82.1
Io Note2	dBm/95.04 MHz Note4	-54.9	-54.9	-54.9	-54.9

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the center of the quiet zone.
Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.

A.7.5.8.1.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on TCI state 0 till n+ T_{HARQ} +3 ms
- be able to start receiving on TCI state 1 after n+ T_{HARQ} +5 ms + $T_{first\text{-}SSB}$

A.7.5.8.2 RRC based active TCI state switch

A.7.5.8.2.1 NR PCell FR2 active TCI state switch for a known TCI state

A.7.5.8.2.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3. Supported test configuration is shown in Table A.7.5.8.2.1.1-1.

The test scenario comprises of one NR PCell as given in Table A.7.5.8.2.1.1-2. Cell-specific parameters of NR PCell is specified in Table A.7.5.8.2.1.1-3 below. The OTA related test parameters for FR2 is shown in Table A.7.5.8.2.1.1-4.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).

- UE is configured with 1 TCI state for PCell, PDCCH-TCI-state0 (QCL'd to SSB0)
- UE is indicated in TCI state0 as the active TCI state

The test consists of two time periods, T1 and T2. During T1 only SSB to which TCI-state0 is QCL'd is transmitted. At the beginning of T2, the SSB corresponding to TCI-state1 starts transmitting. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a RRC command indicating a switch to TCI-state1.

The test equipment verifies the TCI state switch time in PCell by scheduling the UE on TCI state 1 after n+ $T_{RRC\_processing}$ + $T_{first\text{-}SSB}$ + 2ms.

Table A.7.5.8.2.1.1-1: Supported test configurations

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.5.8.2.1.1-2: General test parameters for TCI state switch

Parameter	Unit	Value	Comment
NR RF Channel Number		1	One NR radio channel is used for this test
Active PCell		Cell 1	PCell on RF channel number 1.
CP length		Normal	
DRX		OFF	
T1	s	0.2	
T2	s	2	

Table A.7.5.8.2.1.1-3: NR Cell specific test parameters for TCI state switch

Parameter	Unit	Cell 1
Frequency Range		FR2
Duplex mode		TDD
TDD configuration		TDDConf.3.1
$BW_{channel}$		100 MHz: $N_{RB,c}$ = 66
Initial DL BWP Configuration		DLBWP.0.2
Dedicated DL BWP Configuration		DLBWP.1.1
Initial UL BWP Configuration		ULBWP.0.2
Dedicated UL BWP Configuration		ULBWP.1.1
PDSCH Reference measurement channel		SR.3.1 TDD
RMSI CORESET parameters		CR.3.1 TDD
Dedicated CORESET parameters		CCR.3.1 TDD
OCNG Patterns		OP.1
SSB Configuration		SSB.1 FR2
SMTC Configuration		SMTC.1
TCI State 0		TCI. State.0
TCI State 1		TCI.State.1
reportConfigType		ssb-Index-RSRP
reportConfigType		periodic
Number of reported RS		2
L1-RSRP reporting period	slot	640
timeRestrictionForChannelMeasurements		configured
TRS Configuration		TRS.2.1 TDD
Correlation Matrix and Antenna Configuration		1x2 Low
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH DMRS to SSS		
EPRE ratio of PBCH to PBCH DMRS		
EPRE ratio of PDCCH DMRS to SSS		
EPRE ratio of PDCCH to PDCCH DMRS		
EPRE ratio of PDSCH DMRS to SSS		
EPRE ratio of PDSCH to PDSCH		
EPRE ratio of OCNG DMRS to SSS(Note 1)		
EPRE ratio of OCNG to OCNG DMRS (Note 1)		
Propagation Condition		AWGN
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.		

Table A.7.5.8.2.1.1-4: OTA related test parameters for TCI state switch

Parameter	Unit	Cell 1			
		SSB0		SSB1	
		T1	T2	T1	T2
Angle of arrival configuration		Setup 3 according to clause A.3.15.3			
		AoA1		AoA2	
Assumption for UE beams Note 6		Rough			
N_{oc} Note 1	dBm/15 kHz	-92.1			
N_{oc} Note 1	dBm/SCS	-83.1			
$\hat{E}_s/N_{oc}$	dB	1	1	-Infinity	1
SS-RSRP Note 2	dBm/120 kHz Note3	-82.1	-82.1	-Infinity	-82.1
Io Note2	dBm/95.04 MHz Note4	-54.9	-54.9	-54.9	-54.9
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 5: As observed with 0dBi gain antenna at the center of the quiet zone. Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation.					

A.7.5.8.2.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with both SSB0 and SSB1.

After receiving RRC command in slot n, UE shall be able to start receiving on TCI state 1 after n+ $T_{RRC\_processing}$ + $T_{first\text{-}SSB}$ + 2ms.

A.7.6 Measurement procedure

A.7.6.1 Intra-frequency Measurements

A.7.6.1.1 SA event triggered reporting test without gap under non-DRX

A.7.6.1.1.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.1.1-1.

Table A.7.6.1.1.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.6.1.1.1-2, A.7.6.1.1.1-3 and A.7.6.1.1.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.1.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
SMTC configuration		1, 2	SMTC.1	
A3-Offset	dB	1, 2	-6	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.7.6.1.1.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
Intial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1, 2	CCR.3.1 TDD		CCR.3.1 TDD	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.1		OP.1	
SSB		1	SSB.1 FR2		SSB.1 FR2	
		2	SSB.2 FR2		SSB.2 FR2	
Propagation Condition		1, 2	AWGN			

Table A.7.6.1.1.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam assumption[Note 4]		1,2	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1, 2	4	4	-Infinity	8
N_{oc} Note 2	dBm/15 KHz	1, 2	-102			
N_{oc} Note 2	dBm/SCS	1	-93			
		2	-90			
SS-RSRP	dBm/SCS	1	-89	-89	-Infinity	-85
		2	-86	-86	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	8
Io	dBm/95.04MHz	1, 2	-58.56		-55.38	

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.1.1.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 2.4s for a UE supporting power class 1,
- 1.44s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.2 SA event triggered reporting test without gap under DRX

A.7.6.1.2.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.2.1-1.

Table A.7.6.1.2.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.6.1.2.1-2 ~ 6.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.1.2.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1, 2	PCell (Cell 1)		
Neighbour cell		1, 2	Cell 2		Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2		One TDD carrier frequency is used for the NR cells.
SMTC configuration		1, 2	SMTC.1		
A3-Offset	dB	1, 2	-6		
CP length		1, 2	Normal		
Hysteresis	dB	1, 2	0		
Time To Trigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.1	DRX.2	DRX related parameters are defined in Table A.7.6.1.2.1-5
Time offset between Cell 1 and Cell 2		1, 2	3 μs		Synchronous cells
T1	s	1, 2	5		
T2	s	1, 2	10	52	

Table A.7.6.1.2.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Intial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.1		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.1		ULBWP.1.1	
RLM-RS		1, 2	SSB		SSB	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1, 2	CCR.3.1 TDD		CCR.3.1 TDD	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.1		OP.1	
SSB		1	SSB.3 FR2		SSB.3 FR2	
		2	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1, 2	AWGN			

Table A.7.6.1.2.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 1 defined in A.3.15.1			
Beam assumption[Note 4]		1,2	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
N_{oc} Note 2	dBm/15 KHz	1, 2	-98			
N_{oc} Note 2	dBm/SCS	1	-89			
		2	-86			
SS-RSRP	dBm/SCS	1	-85	-85	-Infinity	-85
		2	-82	-82	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
Io	dBm/95.04MHz	1, 2	-54.53	-52.18	-54.53	-52.18

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

Table A.7.6.1.2.1-5: Void

Table A.7.6.1.2.1-6: Void

A.7.6.1.2.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2s for a UE supporting power class 1,
- 4.32s for a UE supporting power class 2, 3 and 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2s for a UE supporting power class 1,
- 30.72s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.3 SA event triggered reporting test with per-UE gaps under non-DRX

A.7.6.1.3.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.3.1-1.

Table A.7.6.1.3.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.6.1.3.1-2 ~ 4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

Table A.7.6.1.3.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Value	Comment
Active cell		1, 2	PCell (Cell 1)	
Neighbour cell		1, 2	Cell 2	Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2	One TDD carrier frequency is used for the NR cells.
Gap type		1, 2	Per-UE gaps	
Measurement gap repitition periodicity	ms	1, 2	40	
Measurement gap length	ms	1, 2	6	
Measurement gap offset	ms	1, 2	39	
SMTC configuration		1, 2	SMTC.1	
CSI-RS parameters		1, 2	CSI-RS.3.2 TDD	
A3-Offset	dB	1, 2	-6	
CP length		1, 2	Normal	
Hysteresis	dB	1, 2	0	
Time To Trigger	s	1, 2	0	
Filter coefficient		1, 2	0	L3 filtering is not used
DRX		1, 2	OFF	
Time offset between Cell 1 and Cell 2		1, 2	3 μs	Synchronous cells
T1	s	1, 2	5	
T2	s	1, 2	5	

Table A.7.6.1.3.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Intial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	CSI-RS		SSB	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1, 2	CCR.3.1 TDD		CCR.3.1 TDD	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
PDSCH/PDCCH TCI states		1, 2	TCI.State.2		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.1		OP.1	
SSB		1	SSB.3 FR2		SSB.3 FR2	
		2	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1, 2	AWGN			

Table A.7.6.1.3.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps without DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 3 defined in A.3.15.3			
			AoA1		AoA2	
Beam Assumption[Note 4]		1,2	Rough		Rough	
$\hat{E}_s/I_{ot}$	dB	1, 2	4	4	-Infinity	8
N_{oc} Note 2	dBm/15 KHz	1, 2	-102			
N_{oc} Note 2	dBm/SCS	1	-93			
		2	-90			
SS-RSRP	dBm/SCS	1	-89	-89	-Infinity	-85
		2	-86	-86	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	8
Io	dBm/95.04MHz	1, 2	-58.56		-55.38	

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.1.3.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 3.2s for a UE supporting power class 1,
- 1.92s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.1.4 SA event triggered reporting test with per-UE gaps under DRX

A.7.6.1.4.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.4.1-1.

Table A.7.6.1.4.1-1: supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations.	

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.6.1.4.1-2, A.7.6.1.4.1-3 and A.7.6.1.4.1-4 below.

There are two BWPs configured in Cell 1, BWP1 which contains the cell defining SSB, and BWP2 which does not contain any SSB of Cell 1. During the whole test, BWP2 is always scheduled as the active BWP for the UE.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.1.4.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Value		Comment
			Test 1	Test 2	
Active cell		1, 2	PCell (Cell 1)		
Neighbour cell		1, 2	Cell 2		Cell to be identified.
RF Channel Number		1, 2	1: Cell 1 and Cell 2		One TDD carrier frequency is used for the NR cells.
Gap type		1, 2	Per-UE gaps		
Measurement gap repitition periodicity	ms	1, 2	40		
Measurement gap length	ms	1, 2	6		
Measurement gap offset	ms	1, 2	39		
SMTC configuration		1, 2	SMTC.1		
CSI-RS parameters		1, 2	CSI-RS.3.2 TDD		
A3-Offset	dB	1, 2	-6		
CP length		1, 2	Normal		
Hysteresis	dB	1, 2	0		
Time To Trigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	DRX.1	DRX.2	DRX related parameters are defined in Table A.7.6.1.2.1-5
Time offset between Cell 1 and Cell 2		1, 2	3 µs		Synchronous cells
T1	s	1, 2	5		
T2	s	1, 2	10	52	

Table A.7.6.1.4.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
TDD configuration		1, 2	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	1, 2	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Intial BWP configuration		1, 2	DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1, 2	DLBWP.1.2		DLBWP.1.1	
Active UL BWP configuration		1, 2	ULBWP.1.2		ULBWP.1.1	
RLM-RS		1, 2	SCSI-RS		SSB	
PDSCH RMC configuration		1, 2	SR.3.1 TDD		N/A	
RMSI CORESET RMC configuration		1, 2	CR.3.1 TDD		CR.3.1 TDD	
Dedicated CORESET RMC configuration		1, 2	CCR.3.1 TDD		CCR.3.1 TDD	
TRS configuration		1, 2	TRS.2.1 TDD		N/A	
TCI state		1, 2	CSI-RS.Config.0		N/A	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2	120		120	
OCNG Patterns		1, 2	OP.1		OP.1	
SSB		1	SSB.3 FR2		SSB.3 FR2	
		2	SSB.4 FR2		SSB.4 FR2	
Propagation Condition		1, 2	AWGN			

Table A.7.6.1.4.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 with per-UE gaps with DRX

Parameter	Unit	Config	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		1, 2	Setup 1 defined in A.3.15.1			
Beam Assumption Note 4		1,2	Rough			
$\hat{E}_s/I_{ot}$	dB	1, 2	4	-1.46	-Infinity	-1.46
N_{oc} Note 2	dBm/15 KHz	1, 2	-98			
N_{oc} Note 2	dBm/SCS	1	-89			
		2	-86			
SS-RSRP	dBm/SCS	1	-85	-85	-Infinity	-85
		2	-82	-82	-Infinity	-82
$\hat{E}_s/N_{oc}$	dB	1, 2	4	4	-Infinity	4
Io	dBm/95.04MHz	1,2	-54.53	-52.18	-54.53	-52.18
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

Table A.7.6.1.4.1-5: Void

Table A.7.6.1.4.1-6:Void

A.7.6.1.4.2 Test Requirements

In test 1, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 7.2s for a UE supporting power class 1,
- 4.32s for a UE supporting power class 2, 3 and 4

In test 2, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

- 51.2s for a UE supporting power class 1,
- 30.72s for a UE supporting power class 2, 3 and 4

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2 Inter-frequency Measurements

A.7.6.2.1 SA event triggered reporting tests For FR2 without SSB time index detection when DRX is not used (PCell in FR2)

A.7.6.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.1.1-1, A.7.6.2.1.1-2, and A.7.6.2.1.1-3.

Measurement gap pattern configuration # 13 as defined in Table A.7.6.2.1.1-2 is provided for UE that does not support per-FR gap and for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.1.1-1.

Table A.7.6.2.1.1-1 SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: Void.	

Table A.7.6.2.1.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (Pcell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-30	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3µs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	5.2 for PC1; 3.5 for other PC	

Table A.7.6.2.1.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Cell 1		Cell 2	
			T1	T2	T1	T2
AoA setup		Config 1	Setup 3 as specified in clause A.3.15			
			AoA1		AoA2	

Beam Assumption Note 7			1,2	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
TCI configuration			Config 1	CSI-RS.Config.0		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		N/A		N/A	
N_{oc} Note2		dBm/SCS Note4	Config 1	N/A		N/A	
SS-RSRP Note 3		dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
$\hat{E}_s/I_{ot}$		dB	Config 1	N/A	N/A	-Infinity	N/A
$\hat{E}_s/N_{oc}$		dB	Config 1	N/A	N/A	-Infinity	N/A

Io[Note3]	dBm/95.04 MHz Note5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.2.1.2 Test Requirements

The UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

The UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.2 SA event triggered reporting tests For FR2 without SSB time index detection when DRX is used (PCell in FR2)

A.7.6.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.2.1-1, A.7.6.2.2.1-2, and A.7.6.2.2.1-3.

In test 1&2 measurement gap pattern configuration # 13 as defined in Table A.7.6.2.2.1-2 is provided for UE that does not support per-FR gap and for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.2.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.2.1-1: SA event triggered reporting tests without SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: Void.	

Table A.7.6.2.2.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39		
SMTC-SSB parameters		Config 1	SSB.3 FR2		As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6		
Hysteresis	dB	Config 1	0		
CP length		Config 1	Normal		
TimeToTrigger	s	Config 1	0		
Filter coefficient		Config 1	0		L3 filtering is not used
DRX		Config 1	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3μs		Synchronous cells.
T1	s	Config 1	5		
T2	s	Config 1	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.7.6.2.2.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
Duplex mode			Config 1	TDD		TDD	
$BW_{channel}$		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
TCI configuration			Config 1	CSI-RS.Config.0		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		-104.7		-104.7	
N_{oc} Note2		dBm/SCS Note4	Config 1	-95.7		-95.7	
SS-RSRP Note 3		dBm/SCS Note5	Config 1	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$		dB	Config 1	6	6	-Infinity	9

$\hat{E}_s/N_{oc}$	dB	Config 1	6	6	-Infinity	9
Io[Note3]	dBm/95.04 MHz Note5	Config 1	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.2.2.2 Test Requirements

In test 1 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.3 SA event triggered reporting tests For FR2 with SSB time index detection when DRX is not used (PCell in FR2)

A.7.6.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.3.1-1, A.7.6.2.3.1-2, and A.7.6.2.3.1-3.

Measurement gap pattern configuration # 13 as defined in Table A.7.6.2.3.1-2 is provided for UE that does not support per-FR gap and for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.3.1-1.

Table A.7.6.2.3.1-1: SA event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: Void.	

Table A.7.6.2.3.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value	Comment
NR RF Channel Number		Config 1	1, 2	Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (Pcell)	NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2	NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39	
SMTC-SSB parameters		Config 1	SSB.3 FR2	As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-30	
Hysteresis	dB	Config 1	0	
CP length		Config 1	Normal	
TimeToTrigger	s	Config 1	0	
Filter coefficient		Config 1	0	L3 filtering is not used
DRX		Config 1	OFF	DRX is not used
Time offset between serving and neighbour cells		Config 1	3μs	Synchronous cells.
T1	s	Config 1	5	
T2	s	Config 1	7 for PC1; 4.5 for other PC	

Table A.7.6.2.3.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 3 as specified in clause A.3.15			
				AoA1		AoA2	
Beam Assumption[Note 7]			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
TCI configuration			Config 1	CSI-RS.Config.0		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		N/A		N/A	
N_{oc} Note2		dBm/SCS Note4	Config 1	N/A		N/A	
SS-RSRP Note 3		dBm/SCS Note5	Config 1	-87	-87	-Infinity	-87
$\hat{E}_s/I_{ot}$		dB	Config 1	N/A	N/A	N/A	N/A

$\hat{E}_s/N_{oc}$	dB	Config 1	N/A	N/A	N/A	N/A
Io[Note3]	dBm/95.04 MHz Note5	Config 1	-58.01	-58.01	-Infinity	-58.01
Propagation Condition		Config 1	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.2.3.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

The UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.4 SA event triggered reporting tests For FR2 with SSB time index detection when DRX is used (PCell in FR2)

A.7.6.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR2 on NR RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.4.1-1, A.7.6.2.4.1-2, and A.7.6.2.4.1-3.

In test 1&2 measurement gap pattern configuration # 13 as defined in Table A.7.6.2.4.1-2 is provided for UE that does not support per-FR gap and for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A3 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Supported test configurations are shown in table A.7.6.2.4.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.4.1-1: SA event triggered reporting tests with SSB index reading for FR2-FR2

Config	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: Void.	

Table A.7.6.2.4.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1	1, 2		Two FR2 NR carrier frequencies is used.
Active cell		Config 1	NR cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1	13		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1	39		
SMTC-SSB parameters		Config 1	SSB.3 FR2		As specified in clause A.3.10.2
A3-Offset	dB	Config 1	-6		
Hysteresis	dB	Config 1	0		
CP length		Config 1	Normal		
TimeToTrigger	s	Config 1	0		
Filter coefficient		Config 1	0		L3 filtering is not used
DRX		Config 1	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3μs		Synchronous cells.
T1	s	Config 1	5		
T2	s	Config 1	11 for PC1; 6.5 for other PC	108 for PC1; 67 for other PC	

Table A.7.6.2.4.1-3: Cell specific test parameters for CA inter-frequency event triggered reporting with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1	Setup 1 as specified in clause A.3.15			
Beam Assumption Note 7			Config 1	Rough		Rough	
NR RF Channel Number			Config 1	1		2	
Duplex mode			Config 1	TDD		TDD	
TDD configuration			Config 1	TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.3.1 TDD		-	
CORESET Reference Channel			Config 1	CR.3.1 TDD		-	
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1	120		120	
TRS configuration			Config 1	TRS.2.1 TDD		N/A	
TCI configuration			Config 1	CSI-RS.Config.0		N/A	
EPRE ratio of PSS to SSS			Config 1	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2		dBm/15 kHz Note5		-104.7		-104.7	
N_{oc} Note2		dBm/SCS Note4	Config 1	-95.7		-95.7	
SS-RSRP Note 3		dBm/SCS Note5	Config 1	-89.7	-89.7	-Infinity	-86.7
$\hat{E}_s/I_{ot}$		dB	Config 1	6	6	-Infinity	9

$\hat{E}_s/N_{oc}$	dB	Config 1	6	6	-Infinity	9
Io[Note3]	dBm/95.04 MHz Note5	Config 1	-59.7	-59.7	-66.7	-57.2
Propagation Condition		Config 1	AWGN			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.2.4.2 Test Requirements

In test 1 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.5 SA event triggered reporting tests for FR2 without SSB time index detection when DRX is not used (PCell in FR1)

A.7.6.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.5.1-1, A.7.6.2.5.1-2, and A.7.6.2.5.1-3.

In test 1 per-UE measurement gap pattern configuration # 0 as defined in Table A.7.6.2.5.1-2 is provided for a UE that does not support per-FR gap and in test 2 no gap pattern is configured as defined in Table A.7.6.2.5.1-2. If the UE supports per-FR gap, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.7.6.2.5.1-1.

Table A.7.6.2.5.1-1 SA event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
Note: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.5.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3	NR cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	Gap not configured	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39	N/A	
SMTC-SSB parameters on NR RF Channel 1		Config 1	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3	SSB.2 FR1		As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2		As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3	6		
Hysteresis	dB	Config 1,2,3	0		
a4-Threshold	dBm	Config 1,2,3	-120		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	OFF		DRX is not used
Time offset between serving and neighbour cells		Config 1	3ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		Config 2,3	3µs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	5.2 for PC1; 3.5 for other PC	3 for PC1; 2 for other PC	

Table A.7.6.2.5.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	N/A		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]			Config 1,2,3	N/A		Rough	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD		TDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.3.1	
			Config 2	TDDConf.1.1		TDDConf.3.1	
			Config 3	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 2	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 3	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 2	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 3	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		-	
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.2		SMTC.2	
			Config 2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15		120	
			Config 3	30		120	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

N_{oc} Note2	dBm/15 kHz Note5			NA	
N_{oc} Note2	dBm/SCS Note4	Config 1,2		NA	
		Config 3		NA	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2		-Infinity	-87
		Config 3		-Infinity	-87
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	NA Link only, see clause A.3.7A	-Infinity	NA
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3		-Infinity	NA
Io Note3	dBm/9.36MHz	Config 1,2		-	-
	dBm/38.16MHz	Config 3		-	-
	dBm/95.04 MHz Note5	Config 1,2,3		-Infinity	-58.01
Propagation Condition		Config 1,2,3	AWGN		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.2.5.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

5120 for UE supporting power class 1, or

3200 for UE supporting other power class.

In test 2, without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

2560 for UE supporting power class 1, or

1600 for UE supporting other power class.

In test 1 and 2 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.6 SA event triggered reporting tests for FR2 without SSB time index detection when DRX is used (PCell in FR1)

A.7.6.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.6.1-1, A.7.6.2.6.1-2, and A.7.6.2.6.1-3.

In test 1&2 per-UE measurement gap pattern configuration # 0 as defined in Table A.7.6.2.6.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 no gap pattern is configured as defined in Table A.7.6.2.6.1-2. If a UE supports per-FR gap it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.7.6.2.6.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.6.1-1: SA event triggered reporting tests without SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
Note: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.6.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
NR RF Channel Number		Config 1,2,3	1, 2				One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3	NR cell 1 (Pcell)				NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2				NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0		Gap not configured		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39		N/A		
SMTC-SSB parameters on NR RF Channel 1		Config 1	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2	SSB.1 FR1				As specified in clause A.3.10.1
		Config 3	SSB.2 FR1				As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2				As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3	6				
Hysteresis	dB	Config 1,2,3	0				
a4-Threshold	dBm	Config 1,2,3	-120				
CP length		Config 1,2,3	Normal				
TimeToTrigger	s	Config 1,2,3	0				
Filter coefficient		Config 1,2,3	0				L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3ms				Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		Config 2,3	3μs				Synchronous cells.
T1	s	Config 1,2,3	5				
T2	s	Config 1,2,3	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	8 for PC1; 5 for other PC	82 for PC1; 52 for other PC	

Table A.7.6.2.6.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 without SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	NA		Setup 1 as specified in clause A.3.15	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD		TDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.3.1	
			Config 2	TDDConf.1.1		TDDConf.3.1	
			Config 3	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 2	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 3	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 2	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 3	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		-	
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.2		SMTC.2	
			Config 2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15		120	
			Config 3	30		120	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							

EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2	dBm/15 kHz Note5		NA Link only, see clause A.3.7A	-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2		-95.7	
		Config 3		-95.7	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2		-Infinity	-86.7
		Config 3		-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3		-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3		-Infinity	9
Io Note3	dBm/9.36MHz	Config 1,2		-	-
	dBm/38.16MHz	Config 3		-	-
	dBm/95.04 MHz Note5	Config 1,2,3		-66.7	-57.2
Propagation Condition		Config 1,2,3	AWGN		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone

A.7.6.2.6.2 Test Requirements

In test 1 with per-UE gap and in test 3 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

7680 for UE supporting power class 1, or

4800 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

81920 for UE supporting power class 1, or

51200 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is not required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.7 SA event triggered reporting tests for FR2 with SSB time index detection when DRX is not used (PCell in FR1)

A.7.6.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

n this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.7.1-1, A.7.6.2.7.1-2, and A.7.6.2.7.1-3.

In test 1 per-UE measurement gap pattern configuration # 0 as defined in Table A.7.6.2.7.1-2 is provided for a UE that does not support per-FR gap and in test 2 measurement no gap pattern is configured as defined in Table A.7.6.2.7.1-2. If the UE supports per-FR gap, it is only required to pass test 2. Otherwise it is only required to pass test 1.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.7.6.2.7.1-1.

Table A.7.6.2.7.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
Note: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.7.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
NR RF Channel Number		Config 1,2,3	1, 2		One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3	NR cell 1 (Pcell)		NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2		NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0	Gap not configured	As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39	N/A	
SMTC-SSB parameters on NR RF Channel 1		Config 1	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3	SSB.2 FR1		As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2		As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3	6		
Hysteresis	dB	Config 1,2,3	0		
a4-Threshold	dBm	Config 1,2,3,4,5,6	-120		
CP length		Config 1,2,3	Normal		
TimeToTrigger	s	Config 1,2,3	0		
Filter coefficient		Config 1,2,3	0		L3 filtering is not used
DRX		Config 1,2,3	OFF		DRX is not used
Time offset between serving and neighbour cells		Config 1	3ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		Config 2,3	3μs		Synchronous cells.
T1	s	Config 1,2,3	5		
T2	s	Config 1,2,3	7 for PC1; 4.5 for other PC	3.5 for PC1; 2.5 for other PC	

Table A.7.6.2.7.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1		Cell 2	
				T1	T2	T1	T2
AoA setup			Config 1,2,3	NA		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]			Config 1,2,3	N/A		Rough	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD		TDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.3.1	
			Config 2	TDDConf.1.1		TDDConf.3.1	
			Config 3	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 2	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 3	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 2	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 3	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		-	
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.2		SMTC.2	
			Config 2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15		120	
			Config 3	30		120	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

N_{oc} Note2	dBm/15 kHz Note5			NA	
N_{oc} Note2	dBm/SCS Note4	Config 1,2		NA	
		Config 3		NA	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2		-Infinity	-87
		Config 3		-Infinity	-87
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3	NA Link only, see clause A.3.7A	-Infinity	NA
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3		-Infinity	NA
Io Note3	dBm/9.36MHz	Config 1,2		-	-
	dBm/38.16MHz	Config 3		-	-
	dBm/95.04 MHz Note5	Config 1,2,3		Infinity	-58.01
Propagation Condition		Config 1,2,3	AWGN		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.2.7.2 Test Requirements

In test 1 with per-UE gap and in test 2 with per-FR gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

6720 for UE supporting power class 1, or

4160 for UE supporting other power class.

In test 2 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X ms from the beginning of time period T2, where X is

3360 for UE supporting power class 1, or

2080 for UE supporting other power class.

In test 1 and 2 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.2.8 SA event triggered reporting tests for FR2 with SSB time index detection when DRX is used (PCell in FR1)

A.7.6.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the SA inter-frequency NR cell search requirements in clause 9.3.4.

In this test, there are two cells: NR cell 1 as PCell in FR1 on NR RF channel 2 and NR cell 2 as neighbour cell in FR2 on NR RF channel 2. The test parameters and configurations are given in Tables A.7.6.2.8.1-1, A.7.6.2.8.1-2, and A.7.6.2.8.1-3.

In test 1&2 per-UE measurement gap pattern configuration # 0 as defined in Table A.7.6.2.8.1-2 is provided for a UE that does not support per-FR gap and in test 3&4 measurement no gap pattern is configured as defined in Table A.7.6.2.8.1-2.If a UE supports per-FR gap , it is only required to pass test 3&4. Otherwise it is only required to pass test 1&2.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event A4 is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 3.

Supported test configurations are shown in table A.7.6.2.8.1-1.

UE needs to be provided at least once every 500ms with new Timing Advance Command MAC control element to restart the Time alignment timer to keep UE uplink time alignment. Furhtermore UE is allocated with PUSCH resource at every DRX cycle.

Table A.7.6.2.8.1-1: SA event triggered reporting tests with SSB index reading for FR1-FR2

Config	Description of serving cell	Description of target cell
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	
Note: The UE is only required to be tested in one of the supported test configurations		

Table A.7.6.2.8.1-2: General test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
NR RF Channel Number		Config 1,2,3	1, 2				One NR FR1 and one NR FR2 carrier frequency is used.
Active cell		Config 1,2,3	NR cell 1 (Pcell)				NR Cell 1 is on NR RF channel number 1.
Neighbour cell		Config 1,2,3	NR cell 2				NR cell 2 is on NR RF channel number 2.
Gap Pattern Id		Config 1,2,3	0		Gap not configured		As specified in clause 9.1.2-1.
Measurement gap offset		Config 1,2,3	39		N/A		
SMTC-SSB parameters on NR RF Channel 1		Config 1	SSB.1 FR1				As specified in clause A.3.10.1
		Config 2	SSB.1 FR1				As specified in clause A.3.10.1
		Config 3	SSB.2 FR1				As specified in clause A.3.10.1
SMTC-SSB parameters on NR RF Channel 2		Config 1,2,3	SSB.3 FR2				As specified in clause A.3.10.2
offsetMO	dB	Config 1,2,3	6				
Hysteresis	dB	Config 1,2,3	0				
a4-Threshold	dBm	Config 1,2,3	TBD				
CP length		Config 1,2,3	Normal				
TimeToTrigger	s	Config 1,2,3	0				
Filter coefficient		Config 1,2,3	0				L3 filtering is not used
DRX		Config 1,2,3	DRX.1	DRX.2	DRX.1	DRX.2	As specified in clause A.3.3
Time offset between serving and neighbour cells		Config 1	3ms				Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		Config 2,3	3μs				Synchronous cells.
T1	s	Config 1,2,3	5				
T2	s	Config 1,2,3	11 for PC1; 6.5 for other PCTBD	108 for PC1; 67 for other PCTBD	11 for PC1; 6.5 for other PCTBD	108 for PC1; 67 for other PCTBD	

Table A.7.6.2.8.1-3: Cell specific test parameters for SA inter-frequency event triggered reporting for FR2 with SSB time index detection

Parameter		Unit	Test configuration	Cell 1 T1	Cell 1 T2	Cell 2 T1	Cell 2 T2
AoA setup			Config 1,2,3	NA		Setup 1 as specified in clause A.3.15	
Beam Assumption[Note 7]			Config 1,2,3	N/A		Rough	
NR RF Channel Number			Config 1,2,3	1		2	
Duplex mode			Config 1	FDD		TDD	
			Config 2,3	TDD		TDD	
TDD configuration			Config 1	Not Applicable		TDDConf.3.1	
			Config 2	TDDConf.1.1		TDDConf.3.1	
			Config 3	TDDConf.2.1		TDDConf.3.1	
$BW_{channel}$		MHz	Config 1	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 2	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 3	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP BW		MHz	Config 1	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 2	10: $N_{RB,c}$ = 52		100: $N_{RB,c}$ = 66	
			Config 3	40: $N_{RB,c}$ = 106		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		Config 1,2,3	DLBWP.0.1		N/A	
	Initial UL BWP			ULBWP.0.1		N/A	
	Dedicated DL BWP			DLBWP.1.1		N/A	
	Dedicated UL BWP			ULBWP.1.1		N/A	
OCNG Patterns defined in A.3.2.1.1 (OP.1)			Config 1,2,3	OP.1		OP.1	
PDSCH Reference measurement channel			Config 1	SR.1.1 FDD		-	
			Config 2	SR.1.1 TDD			
			Config 3	SR2.1 TDD			
CORESET Reference Channel			Config 1	CR.1.1 FDD		-	
			Config 2	CR.1.1 TDD			
			Config 3	CR2.1 TDD			
SMTC configuration defined in A.3.11.1 and A.3.11.2			Config 1	SMTC.2		SMTC.2	
			Config 2,3	SMTC.1		SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	Config 1,2	15		120	
			Config 3	30		120	
EPRE ratio of PSS to SSS			Config 1,2,3	0		0	
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							

N_{oc} Note2	dBm/15 kHz Note5		NA Link only, see clause A.3.7A	-104.7	
N_{oc} Note2	dBm/SCS Note4	Config 1,2		-95.7	
		Config 3		-95.7	
SS-RSRP Note 3	dBm/SCS Note5	Config 1,2		-Infinity	-86.7
		Config 3		-Infinity	-86.7
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3		-Infinity	9
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3		-Infinity	9
Io Note3	dBm/9.36MHz	Config 1,2		-	-
	dBm/38.16MHz	Config 3		-	-
	dBm/95.04 MHz Note5	Config 1,2,3		-66.7	-57.2
Propagation Condition		Config 1,2,3		AWGN	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 6: As observed with 0 dBi gain antenna at the centre of the quiet zone
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.2.8.2 Test Requirements

In test 1 with per-UE gap and in test 3 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X1 ms from the beginning of time period T2, where X1 is

10080 for UE supporting power class 1, or

6240 for UE supporting other power class.

In test 2 with per-UE gap and in test 4 without the gap, the UE shall send one Event A4 triggered measurement report, with a measurement reporting delay less than X2 ms from the beginning of time period T2, where X2 is

107520 for UE supporting power class 1, or

66560 for UE supporting other power class.

In test 1, 2, 3 and 4 UE is required to report SSB time index. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.3 L1-RSRP measurement for beam reporting

A.7.6.3.1 SSB based L1-RSRP measurement when DRX is not used

A.7.6.3.1 SSB based L1-RSRP measurement when DRX is not used

A.7.6.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in Table A.7.6.3.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.7.6.3.1.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.1.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.6.3.1.2-1 and Table A.7.6.3.1.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.7.6.3.1.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		Off
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2
L1-RSRP reporting period	1~2	slot	640
T1	1~2	s	5
T2	1~2	s	2
Propagation condition	1~2		AWGN
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS[Note 1]			
EPRE ratio of OCNG to OCNG DMRS [Note 1]			
Propagation condition	1~2		AWGN
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.1.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1-2		Rough			
N_{oc} Note2	1~2	dBm/15kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s/I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB RSRP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04MHz	-67.5	-67.5	-71.1	-60.7
	2		-67.5	-67.5	-71.1	-60.7
$\hat{E}_s/N_{oc}$	1~2	dB	0	0	-Infinity	9

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.6.3.1.3 Test Requirements

The UE shall send L1-RSRP report every 640 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 1680 for UE supporting power class 1
- 1200 for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI$_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.3.2 SSB based L1-RSRP measurement when DRX is used

A.7.6.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.1, with the testing configurations for NR cells in Table A.7.6.3.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15

Table A.7.6.3.2.1-1: Applicable NR configurations for FR2 SSB based L1-RSRP test

Config	Description
1	NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.2.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.6.3.2.2-1 and Table A.7.6.3.2.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the SSBs and report periodically. The test consists of two successive time periods, with time duration of T1 and T2 respectively. The test has higher layer parameter *timeRestrictionForChannelMeasurements* configured.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSBs.

Table A.7.6.3.2.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1~2		freq1
Duplex mode	1~2		TDD
TDD Configuration	1~2		TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
	2		SSB.2 FR2
OCNG Patterns	1~2		OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3
SMTC configuration	1~2		SMTC.1
TRS Configuration	1~2		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2
DRX configuration	1~2		DRX.3
reportConfigType	1~2		periodic
reportQuantity	1~2		ssb-Index-RSRP
Number of reported RS	1~2		2
L1-RSRP reporting period	1~2	slot	640
T1	1~2	s	5
T2	1~2	s	3
Propagation condition	1~2		AWGN
EPRE ratio of PSS to SSS	1~2	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Propagation condition	1~2		AWGN
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.2.2-2: SSB specific test parameters

Parameter	Config	Unit	SSB#0		SSB#1	
			T1	T2	T1	T2
Angle of arrival configuration			Setup 1 according to A.3.15.1			
Beam Assumption Note 4	1-2		Rough			
N_{oc} Note2	1~2	dBm/15kHz	-105			
N_{oc} Note2	1	dBm/SSB SCS	-96			
	2		-93			
$\hat{E}_s/I_{ot}$	1~2	dB	0	0	-Infinity	9
SSB RSRP Note3	1	dBm/SSB SCS	-96	-96	-Infinity	-87
	2		-93	-93	-Infinity	-84
Io Note3	1	dBm/95.04MHz	-67.5	-67.5	-71.1	-60.7
	2		-67.5	-67.5	-71.1	-60.7
$\hat{E}_s/N_{oc}$	1~2	dB	0	0	-Infinity	9
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.6.3.2.3 Test Requirements

The UE shall send L1-RSRP report every 640 slots. No later than X ms plus 640 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1, where X is

- 2880 for UE supporting power class 1
- 1920 for UE supporting power class 2,3 or 4.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -10 to +20 dB.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI$_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.3.3 CSI-RS based L1-RSRP measurement when DRX is not used

A.7.6.3.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in Table A.7.6.3.3.1-1.

Table A.7.6.3.3.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.3.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.6.3.3.2-1 and Table A.7.6.3.3.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 480ms from the beginning of the test, the DCI trigger comes in slot 8 of a frame and UE provides the report back based on the reporting configuration as defined in Table A.7.6.3.3.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.7.6.3.3.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
CSI-RS configuration	1		CSI-RS.3.3 TDD
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1		SMTC.1
TRS Configuration	1		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
DRX configuration	1		Off
reportConfigType	1		aperiodic
reportQuantity	1		cri-RSRP
Number of reported RS	1		2
qcl-Info	1		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1		26
Propagation condition	1		AWGN
T1	1	s	5
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.3.2-1: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1		Setup 1 according to A.3.15.1	
Beam Assumption Note 4	1		Rough	Rough
N_{oc} Note1	1	dBm/15kHz	-105	
N_{oc} Note1	1	dBm/SSB SCS	-95.97	
$\hat{E}_s/I_{ot}$	1	dB	0	9
CSI-RS RSRP Note2	1	dBm/SSB SCS	-95.97	-86.97
Io Note2	1	dBm/95.04MHz	-63.97	-57.47
$\hat{E}_s/N_{oc}$	1	dB	0	9
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.6.3.3.3 Test Requirements

After 480ms from the beginning of the test, the UE shall send L1-RSRP report at slot 26 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range of [-10 ~ +20] dB.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.7.6.3.3.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.2.2-1.

Table A.7.6.3.3.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}
Note 1: CSI-RS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.3.4 CSI-RS based L1-RSRP measurement when DRX is used

A.7.6.3.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of L1-RSRP measurement. This test will partly verify the L1-RSRP measurement requirements in clause 9.5.4.2, with the testing configurations for NR cells in Table A.7.6.3.4.1-1.

Table A.7.6.3.4.1-1: Applicable NR configurations for FR2 CSI-RS based L1-RSRP test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

A.7.6.3.4.2 Test parameters

There is one cells in the test, the FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.6.3.4.2-1 and Table A.7.6.3.4.2-2 below.

In CSI measurement configuration, UE is indicated to perform L1-RSRP measurement on the CSI-RS and report aperiodically. The test consists of a single time period T1, during which the UE is triggered via DCI to report L1-RSRP on aperiodic CSI-RS resources. UE is also configured to measure L1-RSRP based on SSB. After 1440ms from the beginning of the test, the DCI trigger comes in slot 8 of a frame and UE provides the report back based on the reporting configuration as defined in Table A.7.6.3.4.2-1.

There is no measurement gap configured in the test. Before the test, UE is configured to perform RLM and BFD based on the SSBs.

Table A.7.6.3.4.2-1: General test parameters

Parameter	Config	Unit	Value
SSB GSCN	1		freq1
Duplex mode	1		TDD
TDD Configuration	1		TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2
CSI-RS configuration	1		CSI-RS.3.3 TDD
OCNG Patterns	1		OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1
SMTC configuration	1		SMTC.1
TRS Configuration	1		TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2
DRX configuration	1		DRX.3
reportConfigType	1		aperiodic
reportQuantity	1		cri-RSRP
Number of reported RS	1		2
qcl-Info	1		SSB#0 for resource#0 SSB#1 for resource#1
reportSlotOffsetList	1		26
Propagation condition	1		AWGN
T1	1	s	5
EPRE ratio of PSS to SSS	1	dB	0
EPRE ratio of PBCH DMRS to SSS			
EPRE ratio of PBCH to PBCH DMRS			
EPRE ratio of PDCCH DMRS to SSS			
EPRE ratio of PDCCH to PDCCH DMRS			
EPRE ratio of PDSCH DMRS to SSS			
EPRE ratio of PDSCH to PDSCH DMRS			
EPRE ratio of OCNG DMRS to SSS Note 1			
EPRE ratio of OCNG to OCNG DMRS Note 1			
Note 1: OCNG shall be used such that the resources in Cell 1 are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.			

Table A.7.6.3.4.2-1: CSI-RS specific test parameters

Parameter	Config	Unit	CSI-RS#0	CSI-RS#1
Angle of arrival configuration	1		Setup 1 according to A.3.15.1	
Beam Assumption Note 4	1		Rough	Rough
N_{oc} Note1	1	dBm/15kHz	-105	
N_{oc} Note1	1	dBm/SSB SCS	-95.97	
$\hat{E}_s/I_{ot}$	1	dB	0	9
CSI-RS RSRP Note2	1	dBm/SSB SCS	-95.97	-86.97
Io Note2	1	dBm/95.04MHz	-63.97	-57.47
$\hat{E}_s/N_{oc}$	1	dB	0	9
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: CSI-RS RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation				

A.7.6.3.3.3 Test Requirements

After 1440ms from the beginning of the test, the UE shall send L1-RSRP report at slot 26 from the reception of DCI triggering the L1-RSRP measurement. The L1-RSRP report shall include the results for both CSI-RS#0 and CSI-RS#1 while meeting the accuracy requirements defined in clause 10.1.20.1. The reported L1-RSRP value shall include the Rx antenna gain in the range of [-10 ~ +20] dB.

For absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1, the UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.7.6.3.4.3-1.

For relative accuracy of CSI-RS0 compared with CSI-RS1, the UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.2.2-1.

Table A.7.6.3.4.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}
Note 1: CSI-RS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.4 CLI measurements

A.7.6.4.1 SRS-RSRP measurement with non-DRX

A.7.6.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of SRS-RSRP measurement. This test will verify the SRS-RSRP measurement requirements in clause 9.7.2.5 with the testing configurations for NR cells in Table A.7.6.4.1.1-1.

Table A.7.6.4.1.1-1: Applicable NR configurations for FR2 SRS-RSRP test

Configuration	Description
1	NR 120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode

A.7.6.4.1.2 Test Parameters

One cell is deployed in the test, which is FR2 PCell (Cell 1). The test parameters for PCell is given in Table A.7.6.4.1.2-1 ~ A.7.6.4.1.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system transmits SRS resource for measurement in the DL slot according to the SRS configuration in Table A.7.6.4.1.2-4 and the test parameters for the (virtual) neighbour cell UE in Table A. 7.6.4.1.2-3. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

Table A.7.6.4.1.2-1: General test parameters for SRS-RSRP event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	Cell 1	
RF Channel Number		1	1: Cell 1	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.1	
SRS configuration		1	SRSConf.1	Table A.7.6.4.1.2-4
CP length		1	Normal	
i1-Threshold	dBm	1	-103	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX	ms	1	OFF	Non-DRX
Time offset between DL from serving cell and SRS from test system	µs	1	10.67	
T1	s	1	5	
T2	s	1	1	

Table A.7.6.4.1.2-2: NR Cell specific test parameters for SA SRS-RSRP event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns		1	OP.1	
TRS configuration			TRS.2.1. TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
Propagation Condition		1	AWGN	

Table A.7.6.4.1.2-3: NR OTA Cell specific test parameters for SA SRS-RSRP event triggered reporting for PCell and neighbour cell UE in FR2

Parameter	Unit	Test configuration	Cell 1		Neighbour cell UE	
			T1	T2	T1	T2
AoA setup		1	Setup 1 defined in A.3.15.1			
Beam assumption Note 4		1	Fine			
N_{oc} Note 2	dBm/15 kHz	1	-98		-98	
N_{oc} Note 2	dBm/SCS	1	-89		-89	
$\hat{E}_s/I_{ot}$	dB	1	-	-	-infinity	4
$\hat{E}_s/N_{oc}$	dB	1	-	-	-infinity	4
SRS-RSRP Note 3	dBm/SCS kHz	1	-	-	-infinity	-94
Io	dBm/95.04 MHz	1	-70.01	-68.82	-70.01	-68.82

Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SRS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

Table A.7.6.4.1.2-4: SRS configuration for measurement reporting

	Field	SRSConf.1	Comments
SRS-ResourceSet	srs-ResourceSetId	0	
	srs-ResourceIdList	0	
	resourceType	Periodic	
	Usage	Codebook	
SRS-Resource	SRS-ResourceId	0	
	nrofSRS-Ports	Port1	
	transmissionComb	n2	
	combOffset-n2	0	
	cyclicShift-n2	0	
	resourceMapping startPosition	0	
	resourceMapping nrofSymbols	n1	
	resourceMapping repetitionFactor	n1	
	freqDomainPosition	0	
	freqDomainShift	0	
	freqHopping c-SRS	12	
	freqHopping b-SRS	0	
	freqHopping b-hop	0	
	groupOrSequenceHopping	Neither	
	resourceType	Periodic	
	periodicityAndOffset	sl40, 25	
	sequenceId	0	Any 10 bit number

A.7.6.4.1.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 60 ms from the beginning of time period T2.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTI_{DCCH} higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.6.4.2 CLI-RSSI measurement with non-DRX

A.7.6.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of CLI-RSSI measurement. This test will verify the CLI-RSSI measurement requirements in clause 9.7.3.5 with the testing configurations for NR cells in Table A.7.6.4.2.1-1.

Table A.7.6.4.2.1-1: Applicable NR configurations for FR2 CLI-RSSI test

Configuration	Description
1	NR 120 kHz SCS, 100 MHz bandwidth, TDD duplex mode

A.7.6.4.2.2 Test Parameters

One cell is deployed in the test, which is FR2 PCell (Cell 1). The test parameters for PCell is given in Table A.7.6.4.2.2-1 ~ A.7.6.4.2.2-3 below. In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event I1 is used. The test consists of two successive time periods, with time duration of T1 and T2, respectively.

During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI measurement resource and on 2 data symbols before. The CLI-RSSI measurement resource configuration is in Table A.7.6.4.2.2-4.

Table A.7.6.4.2.2-1: General test parameters for CLI-RSSI event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Value	Comment
Active cell		1	NR Cell 1	
RF Channel Number		1	1: Cell 1	
SSB configuration		1	SSB.1 FR2	
SMTC configuration		1	SMTC.1	
CLI-RSSI configuration		1	CLI-RSSIConf.1	Table A.7.6.4.2.2-4
CP length		1	Normal	
i1-Threshold	dBm	1	-94.5	
Hysteresis	dB	1	0	
Time To Trigger	s	1	0	
Filter coefficient		1	0	L3 filtering is not used
DRX		1	OFF	Non-DRX
Time offset between DL from serving cell and OCNG from test system	μs	1	10.67	
T1	s	1	5	
T2	s	1	1	

Table A.7.6.4.2.2-2: NR Cell specific test parameters for CLI-RSSI event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
TDD configuration		1	TDDConf.3.1	
PDSCH RMC configuration		1	SR.3.1 TDD	
PUSCH parameters		1	N/A	
RMSI CORESET RMC configuration		1	CR.3.1 TDD	
Dedicated CORESET RMC configuration		1	CCR.3.1 TDD	
OCNG Patterns Note 1		1	OP.1	
TRS configuration			TRS.2.1. TDD	
PDSCH/PDCCH TCI state		1	TCI.State.2	
Initial BWP configuration		1	DLBWP.0.1 ULBWP.0.1	
Active DL BWP configuration		1	DLBWP.1.1	
Active UL BWP configuration		1	ULBWP.1.1	
Propagation Condition		1	AWGN	
Note 1: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.7.6.4.2.2-3: NR OTA Cell specific test parameters for CLI-RSSI event triggered reporting for PCell in FR2

Parameter	Unit	Test configuration	Cell 1	
			T1	T2
AoA setup		1	Setup 1 defined in A.3.15.1	
Beam assumption Note 3		1	Fine	Fine
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/15 kHz	1	-119	-108
N_{oc} on CLI-RSSI measurement resource Note 2	dBm/SCS	1	-110	-99
Io on CLI-RSSI measurement resource	dBm/95.04 MHz	1	-81.01	-70.01
Io on CLI-RSSI measurement resource	dBm/1.08 MHz	1	-100.46	-89.46
Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.				

Table A.7.6.4.2.2-4: CLI-RSSI measurement resource configuration for measurement reporting

	Field	CLI-RSSIConf.1
RSSI-Resource	rssi-ResourceId	0
	rssi-SCS	120
	startPRB	0
	nrofPRBs	66
	startPosition	3
	nrofSymbols	11
	rssi-PeriodicityAndOffset	sl40, 25

A.7.6.4.2.3 Test Requirements

The UE shall send one Event I1 triggered measurement report, with a measurement reporting delay less than 5ms from the beginning of time period T2. The nominal RSSI used to evaluate the requirement shall be based on Io.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.7.7 Measurement Performance requirements

A.7.7.1 SS-RSRP

A.7.7.1.1 SA intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.3.1.1 and 10.1.3.1.2 for intra-frequency measurements.

A.7.7.1.1.2 Test parameters

In this set of test cases all cells are on the same carrier frequency. Supported test configurations are shown in Table A.7.7.1.1.2-1. Both absolute and relative accuracy of SS-RSRP intra-frequency measurements are tested by using the parameters in Table A.7.7.1.1.2-2 and A.7.7.1.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in Table A.3.16.2-1 and TRS configuration for Cell 1 is defined in Table A.3.17.2.1-1. The test consists of two time phases T1 and T2.

Table A.7.7.1.1.2-1: SS-RSRP Intra frequency SS-RSRP supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.1.1.2-2: SS-RSRP Intra frequency general test parameters

Parameter	Unit	T1		T2	
		Cell 1	**Cell 2**	**Cell 1**	**Cell 2**
Cell ID		489	0	489	0
SSB ARFCN		freq1		freq1	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 24		100: $N_{RB,c}$ = 24	
Downlink initial BWP configuration		DLBWP.0.1	-	DLBWP.0.1	-
Downlink dedicated BWP configuration		DLBWP.1.1	-	DLBWP.1.1	-
Uplink initial BWP configuration		ULBWP.0.1	-	ULBWP.0.1	-
Uplink dedicated BWP configuration		ULBWP.1.1	-	ULBWP.1.1	-
DRX cycle configuration		Not applicable	-	Not applicable	-
TRS configuration		TRS.2.1 TDD	-	TRS.2.1 TDD	-
TCI state		TCI.State.0	-	TCI.State.0	-
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
Control channel RMC		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.3	OP.3	OP.3	OP.3
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
SMTC configuration		SMTC.1	SMTC.1	SMTC.1	SMTC.1
Time offset with Cell 1	µs	-	3	-	3
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS[Note 1]					

EPRE ratio of OCNG to OCNG DMRS Note 1					
Propagation conditions		AWGN	AWGN	AWGN	AWGN
Antenna configuration		1x2	1x2	1x2	1x2

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Void
Note 3: Void
Note 4: Void
Note 5: Void

Table A.7.7.1.1.2-3: SS-RSRP Intra frequency OTA related test parameters

Parameter	Unit	T1		T2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1			
Assumption for UE beams Note 7		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note4	-91.6		N/A	
N_{oc} Note1	dBm/SCS Note4	-82.6		N/A	
$\hat{E}_s/N_{oc}$	dB	6.0	1.0	N/A	N/A
E_s	dBm/SCS Note4			(Table B.2.2-2 Rx Beam Peak +2.1dB)	(Table B.2.2-2 Rx Beam Peak +2.1dB)
SSB_RP Note2	dBm/SCS	-76.6	-81.6	(Table B.2.2-2 Rx Beam Peak +2.1dB)	(Table B.2.2-2 Rx Beam Peak +2.1dB)
$\hat{E}_s/I_{ot\_BB}$ Note6	dB	2.44	-5.98	-5.98	-5.98
Io Note2	dBm/95.04 MHz Note4	-50.05		(Table B.2.2-2 Rx Beam Peak +29.70dB)	

Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: Void
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: Void
Note 6: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
Note 7: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.1.1.3 Test Requirements

The SS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.3.1.1 and relative accuracy requirements in clause 10.1.3.1.2. The following requirements are to be verified:

During T1:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.7.7.1.1.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 10.1.3.1.2-1.

During T2:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in table A.7.7.1.1.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 10.1.3.1.2-1.

During T1 and T2:

Relative accuracy of Cell 1 during T2 compared with Cell 1 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 10.1.3.1.2-1

Relative accuracy of Cell 2 during T2 compared with Cell 2 during T1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in Table 10.1.3.1.2-1.

Table A.7.7.1.1.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
Cell 1	SSB_RP1 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP1 +δ +G_{max}
Cell 2	SSB_RP2 -δ +G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP2 +δ +G_{max}
Note 1: SSB_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.3.1.1-1, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.1.2 SA inter-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.5.1.1 and 10.1.5.1.2 for intrer-frequency measurements with the testing configurations for NR cells in Table A.7.7.1.2.1-1.

Table A.7.7.1.2.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

A.7.7.1.2.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on a different frequency than the PCell. The test parameters and applicability for Cell 1 are defined in A.3.7.2. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.7.1.2.2-1 and Table A.7.7.1.2.2-2 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in Table A.7.7.1.2.2-1 and Table A.7.7.1.2.2-1. The inter-frequency measurements are supported by a measurement gap.

Table A.7.7.1.2.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1~2		freq1	freq2	freq1	freq2
$BW_{channel}$	1~2		100: $N_{RB,c}$ = 24		100: $N_{RB,c}$ = 24	
Gap pattern ID			0		0	
Duplex mode	1~2		TDD	TDD	TDD	TDD
TDD configuration	1~2		TDDConf.3.1		TDDConf.3.1	
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	-	CR.3.1 TDD	-
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	-	CCR.3.1 TDD	-
SSB configuration	1		SSB.3 FR2		SSB.3 FR2	
	2		SSB.4 FR2		SSB.4 FR2	
PDSCH/PDCCH subcarrier spacing	1~2	kHz	120		120	
OCNG Patterns	1~2		OP.3		OP.3	
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~2		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2		TCI.State.2	
SMTC configuration	1~2		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 3	1~2	µs	3		3	
EPRE ratio of PSS to SSS	1~2	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						
EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~2	-	AWGN	AWGN	AWGN	AWGN
Antenna configuration	1~2	-	1x2	1x2	1x2	AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Void.						

Table A.7.7.1.2.2-2: SS-RSRP inter frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration	1~2		Setup 4b according to clause A.3.15.4.2		Setup 4b according to clause A.3.15.4.2	
			AoA1 Spherical coverage	AoA2 Rx Beam Peak	AoA1 Spherical coverage	AoA2 Rx Beam Peak
Assumption for UE beams Note 7	1~2		Rough		Rough	
N_{oc} Note1	1	dBm/15kHz Note4	-90.6	-90.6	(Table B.2.3-2 Rx Beam Peak Note 8 +1.97dB)	(Table B.2.3-2 Rx Beam Peak Note 8 -3.03dB)
	2		-92.9	-92.9		
N_{oc} Note1	1	dBm/SCS Note4	-81.6	-81.6	(Table B.2.3-2 Rx Beam Peak Note 8 +11.0dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +6.0dB)
	2		-80.9	-80.9	(Table B.2.3-2 Rx Beam Peak Note 8 +14.0dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +9.0dB)
$\hat{E}_s/N_{oc}$	1~2	dB	6.0	6.0	17.0	-1.0
SSB_RP Note2	1	dBm/SCS	-75.6	-75.6	(Table B.2.3-2 Rx Beam Peak Note 8 +28.0dB)	(Table B.2. 3-2 Rx Beam Peak Note 8 +5.0dB)
	2		-74.9	-74.9	(Table B.2.3-2 Rx Beam Peak Note 8 +31.0dB)	(Table B.2. 3-2 Rx Beam Peak Note 8 +8.0dB)
($SSB\_RP_{Cell 1}$ – $SSB\_RP_{Cell 2}$)	1~2	dB	0		23.00	
$\hat{E}_s/I_{ot\,BB}$ Note6	1	dB	5.26	5.96	9.53	-3.46
	2		4.81	5.93		
Io Note2	1	dBm/95.04 MHz Note4	-50.00	-50.00	(Table B.2.3-2 Rx Beam Peak Note 8 +52.68dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +33.13dB)
	2		-50.08	-50.08	(Table B.2.3-2 Rx Beam Peak Note 8 +54.90dB)	(Table B.2.3-2 Rx Beam Peak Note 8 +35.35dB)
($Io_{freq 1}$ – $Io_{freq 2}$)	1~2	dB	0		19.55	

Note 1:	Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2:	SSB_RP, Es/Iot, Io, ($SSB\_RP_{Cell\ 2}$ – $SSB\_RP_{Cell\ 1}$) and ($Io_{freq\ 2}$ – $Io_{freq\ 1}$) levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3:	Void
Note 4:	Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5:	Void
Note 6:	Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P or ΔMB_S from TS 38.101-2 [19] Table 6.2.1.3-4.
Note 7:	Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation
Note 8:	The value in Table B.2.3-2 is the Minimum SSB_RP for SCS_{SSB} = 120 kHz, selected according to the operating band and UE power class, without $\Delta MB_{P,n}$ adjustment.

A.7.7.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 1 and Cell 2 shall fulfil the absolute requirements in clause 10.1.5.1.1 and the relative requirements in clause 10.1.5.1.2.

Test 1:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table A.7.7.1.2.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in A.7.7.1.2.3-2.

Test 2:

Absolute accuracy of Cell 1 and absolute accuracy of Cell 2. The UE is deemed to meet the requirement if the reported SS-RSRP is in the range shown in Table A.7.7.1.2.3-1.

Relative accuracy of Cell 2 compared with Cell 1. The UE is deemed to meet the requirement if the difference in reported SS-RSRP meets the requirements in A.7.7.1.2.3-2.

Table A.7.7.1.2.3-1: SS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 1	SSB_RP1 -δ $+G_{min}$ +X ≤ Reported RSRP(dBm) ≤ SSB_RP1 +δ $+G_{max}$
Cell 2	SSB_RP2 -δ $+G_{min}$ ≤ Reported RSRP(dBm) ≤ SSB_RP2 +δ $+G_{max}$
Note 1:	SSB_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration
Note 2:	δ is the RSRP absolute accuracy requirement from Table 10.1.5.1.1-1, selected according to the Io used in the test
Note 3:	G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class
Note 4:	X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.

Table A.7.7.1.2.3-2: SS-RSRP relative accuracy test requirement

	Test requirement Notes1,2,3,4
Cell 2 – Cell 1	SSB_RP2 - SSB_RP1 -δ ≤ Reported RSRP(dB) ≤ SSB_RP2 - SSB_RP1 +δ –(X)
Note 1: SSB_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the cell n under consideration Note 2: δ is the RSRP relative accuracy requirement from Table 10.1.5.1.2-1 Note 3: Void Note 4: X is the Spherical coverage gain difference in dB, derived as (UE Refsens - UE Spherical coverage) from TS 38.101-2 [19] clauses 7.3.2 and 7.3.4, selected according to the UE power class and operating band. X is always a negative value.	

A.7.7.1.3 SA inter-frequency measurement accuracy with FR1 serving cell and FR2 target cell

A.7.7.1.3.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 10.1.5.1.1 for inter-frequency measurements with the testing configurations in Table A.7.7.1.3.1-1.

Table A.7.7.1.3.1-1: Applicable NR configurations for FR2 inter-frequency SS-RSRP accuracy test

Config	Description of serving cell	Description of target cell
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode	
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode	

A.7.7.1.3.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1) in FR1 and Cell 2 in FR2 . The test parameters for the Cell 1 and Cell 2 are given in Table A.7.7.1.3.2-1 and Table A.7.7.1.3.2-2 below. Both absolute and relative accuracy of RSRP inter-frequency measurements are tested by using the parameters in Table A.7.7.1.3.2-1 and Table A.7.7.1.3.2-2. The inter-frequency measurements are supported by a measurement gap.

Table A.7.7.1.3.2-1: SS-RSRP inter-frequency test parameters

Parameter	Config	Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN	1~3		freq1	freq2	freq1	freq2
$BW_{channel}$	1	MHz	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66	10: $N_{RB,c}$ = 52	100: $N_{RB,c}$ = 66
	2		10: $N_{RB,c}$ = 52		10: $N_{RB,c}$ = 52	
	3		40: $N_{RB,c}$ = 106		40: $N_{RB,c}$ = 106	
Duplex mode	1		FDD	TDD	FDD	TDD
	2		TDD		TDD	
	3		TDD		TDD	
TDD configuration	1		N/A	TDDConf. 3.1	N/A	TDDConf. 3.1
	2		TDDConf. 1.1		TDDConf. 1.1	
	3		TDDConf. 2.1		TDDConf. 2.1	
PDSCH Reference measurement channel	1		SR.1.1 FDD	-	SR.1.1 FDD	-
	2		SR.1.1 TDD		SR.1.1 TDD	
	3		SR.2.1 FDD		SR.2.1 FDD	
RMSI CORESET Reference Channel	1		CR.1.1 FDD	-	CR.1.1 FDD	-
	2		CR.1.1 TDD	-	CR.1.1 TDD	-
	3		CR.2.1 FDD	-	CR.2.1 FDD	-
Dedicated CORESET Reference Channel	1		CCR.1.1 FDD	-	CCR.1.1 FDD	-
	2		CCR.1.1 TDD	-	CCR.1.1 TDD	-
	3		CCR.2.1 TDD	-	CCR.2.1 TDD	-
SSB configuration	1		SSB.1 FR1	SSB.1 FR2	SSB.1 FR1	SSB.1 FR2
	2		SSB.1 FR1		SSB.1 FR1	
	3		SSB.2 FR1		SSB.2 FR1	
OCNG Patterns	1~3		OP.1		OP.1	
Initial BWP Configuration	1~3		DLBWP.0.1 ULBWP.0.1		DLBWP.0.1 ULBWP.0.1	
Dedicated BWP configuration	1~3		DLBWP.1.3 ULBWP.1.3		DLBWP.1.3 ULBWP.1.3	
TRS Configuration	1~3		TRS.2.1 TDD		TRS.2.1 TDD	
PDCCH/PDSCH TCI Configuration	1~3		TCI.State.2		TCI.State.2	
SMTC configuration	1~3		SMTC.1		SMTC.1	
Time offset between Cell 2 and Cell 3	1~3	µs	3		3	
EPRE ratio of PSS to SSS	1~3	dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS						
EPRE ratio of PBCH to PBCH DMRS						
EPRE ratio of PDCCH DMRS to SSS						
EPRE ratio of PDCCH to PDCCH DMRS						
EPRE ratio of PDSCH DMRS to SSS						

EPRE ratio of PDSCH to PDSCH DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
Propagation condition	1~3	-	NA Link only, see clause A.3.7A	AWGN	NA Link only, see clause A.3.7A	AWGN
Antenna configuration	1~3	-		1x2		1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.						

Table A.7.7.1.3.2-2: SS-RSRP inter-frequency OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration according to clause A.3.15			NA	Setup 2b	NA	Setup 2b
Assumption for UE beams Note 4			N/A	Rough	N/A	Rough
N_{oc}	1~4	dBm/15 kHz	NA Link only, see clause A.3.7A	-90	NA Link only, see clause A.3.7A	NA
N_{oc}	1,2	dBm/SS B SCS		-80.97		NA
	3,4			-80.97		NA
$\hat{E}_s/I_{ot}$ $\hat{E}_s/I_{ot}$	1~4	dB		-4		NA
SS-RSRP Note1	1,2	dBm/SCS		-84.97		As in Table B.2.3-2
	3,4			-84.97		As in Table B.2.3-2
Io Note1	1~4	dBm/ 95.04MHz		-50.53		SS-RSRP+28.98
$\hat{E}_s/N_{oc}$	1~4	dB		-4		NA
Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 3: No additional noise is added by the test system in Test 2. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.7.1.3.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 shall fulfil the Absolute requirement in clause 10.1.5.1.1.

A.7.7.2 SS-RSRQ

A.7.7.2.1 SA intra-frequency measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.8.1.1.

A.7.7.2.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in Table A.7.7.2.1.2-1. . The absolute accuracy of SS-RSRQ intra-frequency measurement is test by using the parameters in Table A.7.7.2.1.2-2 and Table A.7.7.2.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell.

Table A.7.7.2.1.2-1: SS-RSRQ Intra frequency SS-RSRQ supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.2.1.2-2: SS-RSRQ Intra frequency test parameters

Parameter		Unit	Test 1		Test 2	
			Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN			Freq1		Freq1	
Duplex mode			TDD		TDD	
TDD configuration			TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$		MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
BWP configuration	Initial DL BWP		DLBWP.0.1			
	Dedicated DL BWP		DLBWP.1.1			
	Initial UL BWP		ULBWP.0.1			
	Dedicated UL BWP		ULBWP.1.1			
TRS configuration			TRS.2.1 TDD		TRS.2.1 TDD	
TCI state			TCI.State.0		TCI.State.0	
PDSCH Reference measurement channel			SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel			CR.3.1 TDD	-	CR.3.1 TDD	
Control channel RMC			CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns			OP.1	OP.1	OP.1	OP.1
SMTC configuration			SMTC.1			
SSB configuration			SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
PDSCH/PDCCH subcarrier spacing		kHz	120	120	120	120
SS-RSSI-Measurement			Not Applicable			
EPRE ratio of PSS to SSS		dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS Note 1						
EPRE ratio of OCNG to OCNG DMRS Note 1						
$\hat{E}_s/N_{oc}$		dB	3	3	-3	-3
Propagation condition			AWGN		AWGN	
Antenna configuration			1x2		1x2	

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: Void.

Table A.7.7.2.1.2-3: SS-RSRQ Intra frequency OTA related test parameters

	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough			
N_{oc} Note1	dBm/15kHz Note 4	-95		-95	
N_{oc} Note1	dBm/SCS Note3	-86		-86	
SS-RSRP Note2	dBm/SCS Note4	-83	-83	-89	-89
SS-RSRQ Note2	dB	-14.77	-14.77	-16.81	-16.81
$\hat{E}_s/I_{ot}$	dB	-1.76	-1.76	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-50		-54	-54

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: NR operating band groups are as defined in Clause 3.5.2.
Note 7: Void
Note 8: Void
Note 9: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.2.1.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1shall be within the range Nominal SS-RSRQ+2.5dB to Nominal SS-RSRQ-3.5dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal RSRQ+3.5dB to Nominal RSRQ-4.5dB according to the requirements in clause 10.1.8.1.1 with an additional -1dB margin reflecting the possible impact of UE self noise in the test.Nominal RSRQ is the value shown in table A.7.7.2.1.2-3. Relative accuracy shall fulfil the requirements in clause 10.1.8.1.1.

A.7.7.2.2 SA Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.7.7.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 10.1.9.1.1 and 10.1.9.1.2 for inter-frequency measurement.

A.7.7.2.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.7.7.2.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-RSRQ inter-frequency measurement are tested by using test parameters in Table A.7.7.2.2.2-2 and Table A.7.7.2.2.2-3.. In all test cases, Cell 1 is the PCell and Cell 2 is target cell.

Table A. 7.7.2.2.2-1: SS-RSRQ Inter frequency SS-RSRQ supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.2.2.2-2: SS-RSRQ Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		Freq1	freq2	freq1	Freq2
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC. 1 FR2	SMTC. 1 FR2	SMTC. 1 FR2	SMTC. 1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS[Note 1]					
$\hat{E}_s / N_{oc}$	dB	-1.75	-1.75	-3	-1.75
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRQ, SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					

Table A.7.7.2.2.2-3: SS-RSRQ Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
AoA setup		Setup 1 in clause A.3.15.		Setup 1 in clause A.3.15.	
Assumption for UE beams Note 8		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note4	-94.03		-94.03	
N_{oc} Note1	dBm/SCS Note 3	-85.0		-85.0	
SSB_RP Note2	dBm/SCS Note4	-86.75	-86.75	-88	-88
SS-RSRQ Note2	dB	-14.75	-14.75	-15.56	-15.56
$\hat{E}_s/I_{ot}$	dB	-1.75	-1.75	-3	-3
Io Note2	dBm/95.04 MHz Note4	-53.8	-53.8	-54.25	-54.25

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-RSRQ, SSB_RP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-RSRQ and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone
Note 5: As observed with 0dBi gain antenna at the centre of the quiet zone
Note 6: ClauseVoid
Note 7: Void
Note 8: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.2.2.3 Test Requirements

The SS-RSRQ absolute measurement accuracy in test 1 shall be within the range Nominal SS-RSRQ+2.5dB to Nominal SS-RSRQ -3.5dB and the SS-RSRQ measurement accuracy in test 2 shall be within the range Nominal SS-RSRQ +3.5dB to Nominal SS-RSRQ -4.5dB according to the requirements in clause 10.1.10.1.1 with an additional -1dB margin reflecting the possible impact of UE self noise in the test.

The SS-RSRQ relative measurement accuracy shall fulfil the requirements in clause 10.1.10.1.2.

A.7.7.3 SS-SINR

A.7.7.3.1 SA intra-frequency case measurement accuracy with FR2 serving cell and FR2 target cell

A.7.7.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.13.1.1.

A.7.7.3.1.2 Test Parameters

In this test case all cells are on the same carrier frequency. Supported test configurations are shown in Table A.7.7.3.1.2-1. . The absolute accuracy of SS-SINR intra-frequency measurement is test by using the parameters in Table A.7.7.3.1.2-2 and Table A.7.7.3.1.2-3. In all test cases, Cell 1 is the PCell and Cell 2 the target cell. The TCI status for Cell 1 is defined in Table A.3.16.2-1 and TRS configuration for Cell 1 is defined in Table A.3.17.2.1-1.

Table A.7.7.3.1.2-1: SS-SINR Intra frequency SS-SINR supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.3.1.2-2: SS-SINR Intra frequency test parameters

Parameter	Unit	Test 1		Test 2	
		Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		Freq2		Freq2	
Duplex mode		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1			
Downlink dedicated BWP configuration		DLBWP.1.1			
Uplink initial BWP configuration		ULBWP.0.1			
Uplink dedicated BWP configuration		ULBWP.1.1			
DRX cycle configuration	ms	Not applicable			
TRS configuration		TRS.2.1 TDD			
TCI state		TCI.State.0			
PDSCH Reference measurement channel		SR.3.1 TDD		SR.3.1 TDD	
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	
Dedicated RMSI CORESET Reference Channel		CCR.3.1 TDD	-	CCR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1			
SSB configuration		SSB.1 FR2	SSB.1 FR2	SSB.1 FR2	SSB.1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120
SS-RSSI-Measurement		Not Applicable			
EPRE ratio of PSS to SSS	dB	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS					
EPRE ratio of PBCH to PBCH_DMRS					
EPRE ratio of PDCCH_DMRS to SSS					
EPRE ratio of PDCCH to PDCCH_DMRS					
EPRE ratio of PDSCH_DMRS to SSS					
EPRE ratio of PDSCH to PDSCH_DMRS					
EPRE ratio of OCNG DMRS to SSS Note 1					
EPRE ratio of OCNG to OCNG DMRS Note 1					
$\hat{E}_s / N_{oc}$	dB	4.54	2.66	-3	-3
Propagation conditions		AWGN			
Antenna configuration		1x2			

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.7.7.3.1.2-3: SS-SINR Intra frequency OTA related test parameters

Parameter	Unit	Test 1		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration		Setup 1 according to clause A.3.15.1		Setup 1 according to clause A.3.15.1	
Assumption for UE beams Note 9		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note4	-105		-105	
N_{oc} Note1	dBm/SCS Note3	-96		-96	
SS-RSRP Note2	dBm/SCS Note4	-91.46	-93.34	-99	-99
SS-SINR Note2	dB	0	-3.2	-4.76	-4.76
$\hat{E}_s/I_{ot}$	dB	0	-3.2	-4.76	-4.76
Io Note2	dBm/95.04 MHz Note4	-59.2		-64	
Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 2: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone Note 6: NR operating band groups are as defined in clause 3.5.2. Note 7: Void Note 8: Void Note 9: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation					

A.7.7.3.1.3 Test Requirements

The SS-SINR absolute measurement accuracy in test 1 shall be within the range Nominal SS-SINR+3B to Nominal SS-SINR -4dB and the SS-SINR measurement accuracy in test 2 shall be within the range Nominal SS-SINR +3.5dB to Nominal SS-SINR -4.5dB according to the requirements in clause 10.1.10.13.1 with an additional -1dB margin reflecting the possible impact of UE self noise in the test. The relative SS-SINR measurement accuracy shall fulfil the requirements in clause 10.1.13.1.1.

A.7.7.3.2 SA Inter-frequency measurement accuracy with FR2 serving cell and FR2 TDD target cell

A.7.7.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-SINR measurement accuracy is within the specified limits. This test will verify the requirements in Clause 10.1.15.1.1 and 10.1.15.1.2 for inter-frequency measurement.

A.7.7.3.2.2 Test Parameters

In this test case the two cells (i.e., Cell 1 and Cell 2) are on different carrier frequencies and measurement gaps are provided. Supported test configurations are shown in Table A.7.7.3.2.2-1. Both absolute accuracy and relative accuracy requirements of SS-SINR inter-frequency measurement are tested by using test parameters in Table A.7.7.3.2.2-2 and Table A.7.7.3.2.2-3. In all test cases, Cell 1 is the PCell and Cell 2 is target cell. The TCI status for Cell 1 is defined in Table A.3.16.2-1 and TRS configuration for Cell 1 is defined in Table A.3.17.2.1-1.

Table A.7.7.3.2.2-1: SS-SINR Inter frequency SS-SINR supported test configurations

Configuration	Description
1	120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.7.7.3.2.2-2: SS-SINR Inter frequency general test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
SSB ARFCN		freq1	freq2	freq1	freq2	freq1	freq2
Duplex mode		TDD		TDD		TDD	
TDD configuration		TDDConf.3.1		TDDConf.3.1		TDDConf.3.1	
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66		100: $N_{RB,c}$ = 66	
Downlink initial BWP configuration		DLBWP.0.1					
Downlink dedicated BWP configuration		DLBWP.1.1					
Uplink initial BWP configuration		ULBWP.0.1					
Uplink dedicated BWP configuration		ULBWP.1.1					
DRX cycle configuration	ms	Not applicable					
TRS configuration		TRS.2.1 TDD					
TCI state		TCI.State.0					
PDSCH Reference measurement channel		SR.3.1 TDD	-	SR.3.1 TDD	-	SR.3.1 TDD	-
RMSI CORESET Reference Channel		CR.3.1 TDD	-	CR.3.1 TDD	-	CR.3.1 TDD	-
OCNG Patterns		OP.1	OP.1	OP.1	OP.1	OP.1	OP.1
SMTC configuration		SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2	SMTC.1 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0	0	0	0
EPRE ratio of PBCH_DMRS to SSS							
EPRE ratio of PBCH to PBCH_DMRS							
EPRE ratio of PDCCH_DMRS to SSS							
EPRE ratio of PDCCH to PDCCH_DMRS							
EPRE ratio of PDSCH_DMRS to SSS							
EPRE ratio of PDSCH to PDSCH_DMRS							
EPRE ratio of OCNG DMRS to SSS[Note 1]							
$\hat{E}_s/N_{oc}$	dB	-0.5	-0.5	11.0	11.0	-3.0	-3.0
Propagation conditions		AWGN					
Antenna configuration		1x2					

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-SINR, SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

Table A.7.7.3.2.2-3: SS-SINR Inter frequency OTA related test parameters

Parameter	Unit	Test 1		Test 2		Test 3	
		Cell 1	Cell 2	Cell 1	Cell 2	Cell 1	Cell 2
Angle of arrival configuration	degrees	Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 10		Rough		Rough		Rough	
N_{oc} Note1	dBm/15kHz Note4	-105		-105		-105	
N_{oc} Note1	dBm/SCS Note3	-96		-96		-96	
SS-RSRP Note2	dBm/SCS Note4	-96.5	-96.5	-85	-85	-99	-99
SS-SINR Note2	dB	-0.5	-0.5	11	11	-3.0	-3.0
$\hat{E}_s/I_{ot}$	dB	-0.5	-0.5	11	11	-3.0	-3.0
Io Note2	dBm/95.04 MHz Note4	-69.3		-55.4		-65.24	

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: SS-SINR and SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone
Note 5: As observed with 0 dBi gain antenna at the centre of the quiet zone
Note 6: NR operating band groups are as defined in clause 3.5.2.
Note 7: Void
Note 8: Void
Note 9: Void
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation

A.7.7.3.2.3 Test Requirements

The SS-SINR absolute measurement accuracy in test 1 shall be within the range Nominal SS-SINR +3dB to Nominal SS-SINR -4dB and the SS-SINR measurement accuracy in test 2 shall be within the range Nominal SS-SINR +3.5dB to Nominal SS-SINR -4.5dB according to the requirements in clause 10.1.15.1.1 with an additional -1dB margin reflecting the possible impact of UE self noise in the test.

The SS-SINR relative measurement accuracy shall fulfil the requirements in clause 10.1.15.1.2.

A.7.7.4 L1-RSRP measurement for beam reporting

A.7.7.4.1 SSB based L1-RSRP measurement

A.7.7.4.1.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5.2 and clause 10.1.20.1 for L1-RSRP measurements based on SSB with the testing configurations for NR cells in Table A.7.7.4.1.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.7.7.4.1.1-1: Applicable NR configurations for FR1 SSB based L1-RSRP test

Config	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE FDD, NR 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.7.7.4.1.2 Test parameters

In this set of test cases there are two cells in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.7.4.1.2-1 and Table A.7.7.4.1.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.7.7.4.1.2-1 and Table A.7.7.4.1.2-2.

Here is no measurement gap configured in the test. Before the test, UE is configured one SSB resource set with two SSB resources. UE is configured to perform RLM, BFD and L1-RSRP measurement based on the SSB resources 0 and 1.

Table A.7.7.4.1.2-1: FR2 SSB based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1~2		freq1	freq1
Duplex mode	1~2		TDD	TDD
TDD Configuration	1~2		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1~2	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1~2		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1~2		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1~2		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2	SSB.1 FR2
	2		SSB.2 FR2	SSB.2 FR2
OCNG Patterns	1~2		OP.1	OP.1
Initial BWP Configuration	1~2		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1~2		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
TRS Configuration	1~2		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1~2		TCI.State.2	TCI.State.2
SMTC configuration	1~2		SMTC.1	SMTC.1
reportConfigType	1~2		periodic	periodic
reportQuantity	1~2		ssb-Index-RSRP	ssb-Index-RSRP
Number of reported RS	1~2		2	2
L1-RSRP reporting period	1~2		slot640	slot640
Propagation condition	1~2		AWGN	AWGN
Antenna configuration	1~2		1x2	1x2
EPRE ratio of PSS to SSS	1~2	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

Table A.7.7.4.1.2-2: FR2 SSB based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			SSB0	SSB1	SSB0	SSB1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough		Rough	
N_{oc}	1~4	dBm/15 kHz	-100		n.a.	
N_{oc}	1,2	dBm/SSB SCS	-91		n.a.	
	3,4		-88		n.a.	
$\hat{E}_s/I_{ot}$	1~4	dB	10	-2	n.a.	
SS-RSRP Note1	1,2	dBm/SCS	-81	-93	As in Table B.2.4-2	
	3,4		-78	-90	As in Table B.2.4-2	
Io Note1	1~4	dBm/ 95.04MHz	-51.57		SS-RSRP+28.98	
$\hat{E}_s/N_{oc}$	1~4	dB	10	-2	n.a.	
Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 3: No additional noise is added by the test system in Test 2. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.7.4.1.3 Test Requirements

After 640ms from the beginning of the test, , the L1-RSRP measurement accuracy for SSB#0 and SSB#1 of Cell 2 shall fulfil the requirements in clauses 10.1.20.1. The following requirements are to be verified:

For Test 1:

Absolute accuracy of SSB0 and absolute accuracy of SSB1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.7.7.4.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.1.2-1.

For Test 2:

Absolute accuracy of SSB0 and absolute accuracy of SSB1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.7.7.4.1.3-1.

Relative accuracy of SSB0 compared with SSB1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.1.2-1.

Table A.7.7.4.1.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SSB0	SSB_RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP0 +δ + G_{max}
SSB1	SSB_RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤ SSB_RP1 +δ + G_{max}
Note 1: SSB_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the SSB n under consideration Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.1.1-1, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.4.2 CSI-RS based L1-RSRP measurement on resource set with repetition off

A.7.7.4.2.1 Test Purpose and Environment

The purpose of this test is to verify that the L1-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clauses 9.5.3 and clause 10.1.20.2 for L1-RSRP measurements based on CSI-RS with the testing configurations for NR cells in Table A.7.7.4.2.1-1.

The AoA setup for this test is Setup 1 as defined in clause A.3.15.

Table A.7.7.4.2.1-1: Applicable NR configurations for FR1 CSI-RS based L1-RSRP test

Config	Description
1	NR 120 kHz CSI-RS SCS, 100 MHz bandwidth, TDD duplex mode

A.7.7.4.2.2 Test parameters

In this set of test cases there are one cell in the test, PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.7.4.2.2-1 and Table A.7.7.4.2.2-2 below. The absolute and relative accuracy of L1-RSRP measurements are tested by using the parameters in Table A.7.7.4.2.2-1 and Table A.7.7.4.2.2-2.

There is no measurement gap configured in the test. Before the test, UE is configured one CSI-RS resource set with two CSI-RS resources. UE is configured to perform RLM and BFD based on SSB 0 and 1. CSI-RS is not transmitted in the same OFDM symbols as SSB.

Table A.7.7.4.2.2-1: FR2 CSI-RS based L1-RSRP general test parameters

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1		freq1	freq1
Duplex mode	1		TDD	TDD
TDD Configuration	1		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1		SSB.1 FR2	SSB.1 FR2
OCNG Patterns	1		OP.1	OP.1
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.1 ULBWP.1.1	DLBWP.1.1 ULBWP.1.1
TRS Configuration	1		TRS.2.1 TDD	TRS.2.1 TDD
PDCCH/PDSCH TCI Configuration	1		TCI.State.2	TCI.State.2
SMTC configuration	1		SMTC.1	SMTC.1
CSI-RS	1		CSI-RS.3.2 TDD	CSI-RS.3.2 TDD
reportConfigType	1		periodic	periodic
reportQuantity	1		cri-RSRP	cri-RSRP
Number of reported RS	1		2	2
L1-RSRP reporting period	1		slot80	slot80
Propagation condition	1		AWGN	AWGN
Antenna configuration	1		1x2	1x2
EPRE ratio of PSS to SSS EPRE ratio of PBCH DMRS to SSS EPRE ratio of PBCH to PBCH DMRS EPRE ratio of PDCCH DMRS to SSS EPRE ratio of PDCCH to PDCCH DMRS EPRE ratio of PDSCH DMRS to SSS EPRE ratio of PDSCH to PDSCH DMRS EPRE ratio of OCNG DMRS to SSS Note 1 EPRE ratio of OCNG to OCNG DMRS Note 1	1	dB	0	0
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.				

Table A.7.7.4.2.2-2: FR2 CSI-RS based L1-RSRP OTA related test parameters

Parameter	Config	Unit	Test 1		Test 2 NOTE 3	
			CSI-RS0	CSI-RS1	CSI-RS0	CSI-RS1
Angle of arrival configuration			Setup 1 according to A.3.15.1		Setup 1 according to A.3.15.1	
Assumption for UE beams Note 4			Rough		Rough	
N_{oc}	1~2	dBm/15 kHz	-100		n.a.	
N_{oc}	1~2	dBm/SSB SCS	-91		n.a. n.a.	
$\hat{E}_s/I_{ot}$	1~2	dB	10	-2	n.a.	
CSI-RS-RSRP Note1	1~2	dBm/SCS	-81	-93	As in Table B.2.4-2	
Io Note1	1~2	dBm/ 95.04MHz	-59.86		SS-RSRP+28.98	
$\hat{E}_s/N_{oc}$	1~2	dB	-51.57	-2	n.a.	
Note 1: RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 2: RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 3: No additional noise is added by the test system in Test 2. Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation						

A.7.7.4.2.3 Test Requirements

After 640ms from the beginning of the test, the L1-RSRP measurement accuracy for CSI-RS#0 and CSI-RS#1 of Cell 1 shall fulfil the requirements in clause 10.1.20.2. The following requirements are to be verified:

For Test 1:

Absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.7.7.4.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.2.2-1.

For Test 2:

Absolute accuracy of CSI-RS0 and absolute accuracy of CSI-RS1. The UE is deemed to meet the requirement if the reported L1-RSRP is in the range shown in Table A.7.7.4.2.3-1.

Relative accuracy of CSI-RS0 compared with CSI-RS1. The UE is deemed to meet the requirement if the difference in reported L1-RSRP meets the requirements in Table 10.1.20.2.2-1.

Table A.7.7.4.2.3-1: L1-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
CSI-RS0	CSI-RS _RP0 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP0 +δ + G_{max}
CSI-RS1	CSI-RS _RP1 -δ + G_{min} ≤ Reported RSRP(dBm) ≤CSI-RS _RP1 +δ + G_{max}
Note 1: CSI-RS_RPn is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for the CSI-RS n under consideration Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.20.2.1-1, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.5 CLI measurements

A.7.7.5.1 SA SRS-RSRP measurement accuracy with FR2 serving cell

A.7.7.5.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SRS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.22.1.1 with the testing configurations for NR cells in Table A.7.7.5.1.1-1.

Table A.7.7.5.1.1-1: Applicable NR configurations for FR2 SRS-RSRP accuracy test

Config	Description
1	120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.7.7.5.1.2 Test parameters

In this set of test cases there is one cell in the test, FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.7.5.1.2-1 and A.7.7.5.1.2-2 below. The test parameter for the (virtual) neighbor cell UE transmitting SRS are given in Table A.7.7.5.1.2-2.

Before the test UE is configured to perform SRS-RSRP measurement. During the test, the test system transmits SRS resources for measurement in the DL slots according to the SRS configuration in Table A.7.7.5.1.2-3. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on SRS symbol to be transmitted and on 2 data symbols before SRS to be transmitted.

Table A.7.7.5.1.2-1: FR2 test parameters for SRS-RSRP accuracy

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1		freq1	freq1
Duplex mode	1		TDD	TDD
TDD configuration	1		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1		SSB.3 FR2	SSB.3 FR2
OCNG Patterns	1		OP.1	OP.1
TRS configuration	1		TRS.2.1 TDD	TRS.2.1 TDD
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
SMTC configuration	1		SMTC.1	SMTC.1
Time offset between DL from serving cell and SRS from test system	1	μs	10.76	10.67
EPRE ratio of PSS to SSS	1	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1		AWGN	AWGN
Antenna configuration	1		1x2	1x2
Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols.				

Table A.7.7.5.1.2-2: SRS-RSRP accuracy OTA related test parameters for PCell and Neighbour cell UE in FR2

Parameter	Unit	T1	T2
Angle of arrival configuration		Setup 1 defined A.3.15.1	Setup 1 defined A.3.15.1
Beam assumption Note 5		Fine	Fine
N_{oc} Note1	dBm/15kHz Note3	-100	N/A
N_{oc} Note1	dBm/SCS Note3	-91	N/A
$\hat{E}_s/N_{oc}$	dB	2	N/A
E_s	dBm/SCS Note3		(Table B.2.7-2 Rx Beam Peak)
SRS_RP Note2	dBm/SCS	-89	(Table B.2.7-2 Rx Beam Peak)
$\hat{E}_s/I_{ot\ BB}$ Note4	dB	>1	1
Io Note2	dBm/95.04 MHz Note3	-57.89	(Table B.2.7-2 Rx Beam Peak +50.79dB)

Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 2: SRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone

Note 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2dB for UE multi-band relaxation factor $\sum MB_P$ from TS 38.101-2 [19] Table 6.2.1.3-4.

Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

Table A.7.7.5.1.2-3: SRS configuration parameters for FR2 SRS-RSRP accuracy

	Field	SRSConf.1
SRS-ResourceSet	srs-ResourceSetId	0
	srs-ResourceIdList	0
	resourceType	Periodic
	Usage	Codebook
SRS-Resource	SRS-ResourceId	0
	nrofSRS-Ports	Port1
	transmissionComb	n2
	combOffset-n2	0
	cyclicShift-n2	0
	resourceMapping startPosition	0
	resourceMapping nrofSymbols	n1
	resourceMapping repetitionFactor	n1
	freqDomainPosition	0
	freqDomainShift	0
	freqHopping c-SRS	12
	freqHopping b-SRS	0
	freqHopping b-hop	0
	groupOrSequenceHopping	Neither
	resourceType	Periodic
	periodicityAndOffset-p	sl160,25
	sequenceId	0

A.7.7.5.1.3 Test Requirements

The SRS-RSRP measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.22.1.1. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table A.7.7.5.1.3-1.

During T2:

The UE is deemed to meet the requirement if the reported SRS-RSRP is in the range shown in table A.7.7.5.1.3-1.

Table A.7.7.5.1.3-1: SRS-RSRP absolute accuracy test requirement

	Test requirement Notes1,2,3
SRS	SRS_RP $-\delta + G_{min} \leq$ Reported SRS-RSRP(dBm) $\leq$SRS_RP $+\delta + G_{max}$
Note 1: SRS_RP is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.7.7.5.2 SA CLI-RSSI measurement accuracy with FR2 serving cell

A.7.7.5.2.1 Test Purpose and Environment

The purpose of this test is to verify that the CLI-RSSI measurement accuracy is within the specified limits. This test will verify the requirements in Clauses 10.1.22.2.1 with the testing configurations for NR cells in Table A.7.7.5.2.1-1.

Table A.7.7.5.2.1-1: Applicable NR configurations for FR2 CLI-RSSI accuracy test

Config	Description
1	120 kHz SRS SCS, 100 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations in each supported band	

A.7.7.5.2.2 Test parameters

In this set of test cases there is one cell in the test, FR2 PCell (Cell 1). The test parameters for the Cell 1 are given in Table A.7.7.5.2.2-1 and A.7.7.5.2.2-2 below.

Before the test UE is configured to perform CLI-RSSI measurement. There is no measurement gap configured in the test. During the test, the test system does not transmit PDCCH/PDSCH/OCNG on symbols for CLI-RSSI resource and on 2 data symbol before. The CLI-RSSI measurement resource configuration is in Table A.7.7.5.2.2-3.

Table A.7.7.5.2.2-1: FR2 test parameters for CLI-RSSI accuracy

Parameter	Config	Unit	Test 1	Test 2
SSB GSCN	1		freq1	freq1
Duplex mode	1		TDD	TDD
TDD configuration	1		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	1	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
PDSCH Reference measurement channel	1		SR.3.1 TDD	SR.3.1 TDD
RMSI CORESET Reference Channel	1		CR.3.1 TDD	CR.3.1 TDD
Dedicated CORESET Reference Channel	1		CCR.3.1 TDD	CCR.3.1 TDD
SSB configuration	1		SSB.3 FR2	SSB.3 FR2
OCNG Patterns Note2	1		OP.1	OP.1
TRS configuration	1		TRS.2.1 TDD	TRS.2.1 TDD
Initial BWP Configuration	1		DLBWP.0.1 ULBWP.0.1	DLBWP.0.1 ULBWP.0.1
Dedicated BWP configuration	1		DLBWP.1.3 ULBWP.1.3	DLBWP.1.3 ULBWP.1.3
SMTC configuration	1		SMTC.1	SMTC.1
Time offset between DL from serving cell and OCNG from test system	1	μs	10.67	10.67
EPRE ratio of PSS to SSS	1	dB	0	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
Propagation condition	1		AWGN	AWGN
Antenna configuration	1		1x2	1x2
Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: OCNG is not transmitted in the CLI-RSSI measurement resources.				

Table A.7.7.5.2.2-2: CLI-RSSI accuracy OTA related test parameters

Parameter	Unit	T1	T2
Angle of arrival configuration		Setup 1 defined A.3.15.1	
Beam assumption Note 5		Fine	
N_{oc} on CLI-RSSI measurement resource Note1	dBm/15kHz Note3	-100	
N_{oc} on CLI-RSSI measurement resource Note1	dBm/SCS Note3	-91	
$\hat{E}_s/N_{oc}$ on CLI-RSSI measurement resource	dB	-Infinity	
RSRP on CLI-RSSI measurement resource Note2	dBm/SCS	-Infinity	
$\hat{E}_s/I_{ot\ BB}$ on CLI-RSSI measurement resource Note4	dB	-Infinity	
Io on CLI-RSSI measurement resource Note2	dBm/95.04 MHz Note3	-62.01	
Io on CLI-RSSI measurement resource Note2	dBm/1.08 MHz	-81.46	
Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.			
Note 2: SRS_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			
Note 3: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone			
Note 4: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 2dB for UE multi-band relaxation factor $\sum MB_P$ from TS 38.101-2 [19] Table 6.2.1.3-4.			
Note 5: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.			

Table A.7.7.5.2.2-3: CLI-RSSI measurement resource configuration for FR2 CLI-RSSI accuracy

	Field	SRSConf.1
CLI-RSSI measurement resource	rssi-ResourceId	0
	rssi-SCS	120kHz
	startPRB	0
	nrofPRBs	66
	startPosition	3
	nrofSymbols	11
	rssi-PeriodicityAndOffset	sl160, 25

A.7.7.5.2.3 Test Requirements

The CLI-RSSI measurement accuracy shall fulfil the absolute accuracy requirements in clauses 10.1.22.2.1. The following requirements are to be verified:

During T1:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table A.7.7.5.2.3-1.

During T2:

The UE is deemed to meet the requirement if the reported CLI-RSSI is in the range shown in table A.7.7.5.2.3-1.

Table A.7.7.5.2.3-1: CLI-RSSI absolute accuracy test requirement

	Test requirement Notes1,2,3
	Io -δ +G_{min} ≤ Reported CLI-RSSI(dBm) ≤Io +δ +G_{max}
Note 1: Io is the equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone configured in the test for 1.08MHz Note 2: δ is the RSRP absolute accuracy requirement from Table 10.1.22.1.1-2, selected according to the Io used in the test Note 3: G_{min} and G_{max} are the minimum and maximum UE gain values from Table B.2.1.5.1-1, selected according to the UE power class	

A.8 E-UTRA standalone tests for NR RRM

Editor notes: All NR RRM tests under E-UTRA standalone operations are included in this Annex. All EN-DC related NR RRM tests are in A.6

A.8.1 Void

A.8.2 RRC_IDLE state mobility

A.8.2.1 Inter-RAT NR Cell re-selection

A.8.2.1.1 E-UTRA Cell reselection to higher priority NR target Cell in FR1

A.8.2.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the E-UTRAN to NR inter-RAT cell reselection requirements specified in clause 4.2.2.5.6 in TS 36.133 [15].

The test scenario comprises of 1 E-UTRA cell and 1 NR cell as given in tables A.8.2.1.1.1-1, A.8.2.1.1.1-2, A.8.2.1.1.1-3 and A.8.2.1.1.1-4. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. E-UTRA cell 1 is already identified by the UE prior to the start of the test. Cell 2 is of higher priority than cell 1.

Table A.8.2.1.1.1-1: Supported test configurations

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.8.2.1.1.1-2: General test parameters for E-UTRA cell re-selection FR1 NR cell test case

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell2	The UE camps on cell 2 in the initial phase
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell1	
T1 end condition	Active cell			Cell1	During T1 period the UE reselects to cell 1
	Neighbour cell			Cell2	
T3 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell2	The UE shall perform reselection to cell 2 during T3
	Neighbour cell		1, 2, 3, 4, 5, 6	Cell1	
RF Channel Number			1, 2, 3, 4, 5, 6	1, 2	E-UTRAN radio channel (1) and NR radio channel (2) are used for this test
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2, 5	3 μs	Synchronous cells
			3, 6	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	1.28	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	102	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
T1		s	1, 2, 3, 4, 5, 6	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	>7	During T2, cell 2 shall be powered off, and during the off time the physical cell identity shall be changed. The intention is to ensure that cell 2 has not been detected by the UE prior to the start of period T3.
T3		s	1, 2, 3, 4, 5, 6	75	T3 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.8.2.1.1.1-3: Cell specific test parameters for NR cell 2

Parameter	Unit	Test configuration	Cell 2		
			T1	T2	T3
TDD configuration		1, 4	N/A		
		2, 5	TDDConf.1.1		
		3, 6	TDDConf.2.1		
PDSCH Reference measurement channel		1, 4	SR.1.1 FDD		
		2, 5	SR.1.1 TDD		
		3, 6	SR.2.1 TDD		
RMSI CORESET Reference Channel		1, 4	CR.1.1 FDD		
		2, 5	CR.1.1 TDD		
		3, 6	CR.2.1 TDD		
RMC CORESET Reference Channel		1, 4	CCR.1.1 FDD		
		2, 5	CCR.1.1 TDD		
		3, 6	CCR.2.1 TDD		
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1		
SMTC configuration		1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration		1, 4	SSB.1 FR1		
		2, 5	SSB.1 FR1		
		3, 6	SSB.2 FR1		
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1		
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1		
RLM-RS		1, 2, 3, 4, 5, 6	SSB		
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140		
		3, 6	-137		
Pcompensation	dB	1, 2, 3, 4, 5, 6	0		
$Qhyst_s$	dB	1, 2, 3, 4, 5, 6	0		
$Qoffset_{s, n}$	dB	1, 2, 3, 4, 5, 6	0		
Cell_selection_and_reselection_quality_measurement		1, 2, 3, 4, 5, 6	SS-RSRP		
$\hat{E}_s/I_{ot}$	dB	1, 4	-4	-infinity	12
		2, 5			
		3, 6			
N_{oc} Note2	dBm/SCS	1, 4	-98		
		2, 5	-98		
		3, 6	-95		
N_{oc} Note2	dBm/15 kHz	1, 4	-98		
		2, 5			
		3, 6			
$\hat{E}_s/N_{oc}$	dB	1, 4	-4	-infinity	12
		2, 5			
		3, 6			
SS-RSRP Note3	dBm/SCS	1, 4	-102	-infinity	-86
		2, 5	-102	-infinity	-86
		3, 6	-99	-infinity	-83
Io	dBm/9.36 MHz	1, 4	-68.60	-70.05	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-70.05	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-63.95	-51.69
Treselection	s	1, 2, 3, 4, 5, 6	0	0	0
SnonintrasearchP	dB	1, 2, 3, 4, 5, 6	50		
$Thresh_{x, highP}$	dB	1, 2, 3, 4, 5, 6	48		

$Thresh_{serving, lowP}$	dB	1, 2, 3, 4, 5, 6	44
$Thresh_{x, lowP}$	dB	1, 2, 3, 4, 5, 6	50
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.			

Table A.8.2.1.1.1-4: Cell specific test parameters for E-UTRA cell 1

Parameter	Unit	Cell 1		
		T1	T2	T3
E-UTRA RF Channel number		1		
$BW_{channel}$	MHz	10		
OCNG Patterns defined in TS 36.133 [15] clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6		
PBCH_RA	dB	0		
PBCH_RB	dB			
PSS_RA	dB			
SSS_RA	dB			
PCFICH_RB	dB			
PHICH_RA	dB			
PHICH_RB	dB			
PDCCH_RA	dB			
PDCCH_RB	dB			
PDSCH_RA	dB			
PDSCH_RB	dB			
OCNG_RA Note 1	dB			
OCNG_RB Note 1	dB			
Qrxlevmin	dBm	-140		
N_{oc} Note 2	dBm/15 kHz	-98		
RSRP Note 3	dBm/15 KHz	-84	-84	-84
$\hat{E}_s/I_{ot}$	dB	14	14	14
$\hat{E}_s/N_{oc}$	dB	14	14	14
$Treselection_{EUTRAN}$	S	0		
SnonintrasearchP	dB	50		
$Thresh_{x, highP}$	dB	48		
$Thresh_{serving, lowP}$	dB	44		
$Thresh_{x, lowP}$	dB	50		
Propagation Condition		AWGN		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.8.2.1.1.2 Test Requirements

The cell reselection delay to a higher priority NR cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration updateon cell 2.

The cell re-selection delay to a higher priority cell shall be less than 68 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a higher priority cell can be expressed as: $T_{higher\_priority\_search} + T_{evaluate, NR} + T_{SI-NR}$, and to a lower priority cell can be expressed as: $T_{evaluate, NR} + T_{SI-NR}$,

Where:

$T_{higher\_priority\_search}$ See clause 4.2.2 in TS 36.133 [15]

$T_{evaluate, NR}$ See Table 4.2.2.5.6-1 in clause 4.2.2.5.6 in TS 36.133 [15]

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 67.68 s, allow 68 s for the cell re-selection delay to a higher priority NR cell and 7.68 s for the cell re-selection delay to a lower priority cell in the test case, which we allow 8 s.

A.8.2.1.2 E-UTRA Cell reselection to lower priority NR target Cell in FR1 for UE configured with highSpeedInterRAT-NR-r16

A.8.2.1.2.1 Test Purpose and Environment

This test is to verify the requirement for the E-UTRAN to NR inter-RAT cell reselection requirements specified in clause 4.2.2.5.6 in 36.133 [15].

The test scenario comprises of 1 E-UTRA cell and 1 NR cell as given in tables A.8.2.1.2.1-1, A.8.2.1.2.1-2, A.8.2.1.2.1-3 and A.8.2.1.2.1-4. In SIB of the E-UTRA cell, highSpeedInterRAT-NR-r16 is configured and the carrier of NR cell is configured with highSpeedCarrierNR-r16. The test consists of two time periods, with time duration of T1 and T2 respectively. Both E-UTRA cell 1 and NR cell 2 are already identified by the UE prior to the start of the test. NR cell 2 is of lower priority than E-UTRA cell 1.

Table A.8.2.1.2.1-1: Supported test configurations for UE configured with highSpeedInterRAT-NR-r16

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.8.2.1.2.1-2: General test parameters in E-UTRA cell re-selection FR1 NR cell test case for UE configured with highSpeedInterRAT-NR-r16

Parameter		Unit	Test configuration	Value	Comment
Initial condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE camps on cell 1 in the initial phase
T1 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell2	The UE shall perform reselection to cell 2 during T1
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell1	
T2 end condition	Active cell		1, 2, 3, 4, 5, 6	Cell1	The UE shall perform reselection to cell 1 during T2 for iteration of the tests.
	Neighbour cells		1, 2, 3, 4, 5, 6	Cell2	
RF Channel Number			1, 2, 3, 4, 5, 6	1, 2	E-UTRAN radio channel (1) and NR radio channel (2) are used for this test
Time offset between cells			1, 4	3 ms	Asynchronous cells
			2, 5	3 μs	Synchronous cells
			3, 6	3 μs	Synchronous cells
Access Barring Information		-	1, 2, 3, 4, 5, 6	Not Sent	No additional delays in random access procedure.
DRX cycle length		s	1, 2, 3, 4, 5, 6	0.32	The value shall be used for all cells in the test.
NR PRACH configuration index			1, 2, 3, 4, 5, 6	87	The detailed configuration is specified in TS 38.211 clause 6.3.3.2
T1		s	1, 2, 3, 4, 5, 6	15	T1 needs to be defined so that cell re-selection reaction time is taken into account.
T2		s	1, 2, 3, 4, 5, 6	75	T2 needs to be defined so that cell re-selection reaction time is taken into account.

Table A.8.2.1.2.1-3: Cell specific test parameters for NR cell 2 in E-UTRA cell re-selection FR1 NR cell test case for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
TDD configuration		1, 4	N/A	
		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
PDSCH Reference measurement channel		1, 4	SR.1.1 FDD	
		2, 5	SR.1.1 TDD	
		3, 6	SR.2.1 TDD	
RMSI CORESET Reference Channel		1, 4	CR.1.1 FDD	
		2, 5	CR.1.1 TDD	
		3, 6	CR.2.1 TDD	
RMC CORESET Reference Channel		1, 4	CCR.1.1 FDD	
		2, 5	CCR.1.1 TDD	
		3, 6	CCR.2.1 TDD	
OCNG Patterns		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration		1, 2, 3, 4, 5, 6	SMTC.1	
SSB configuration		1, 4	SSB.1 FR1	
		2, 5	SSB.1 FR1	
		3, 6	SSB.2 FR1	
Initial DL BWP configuration		1, 2, 3, 4, 5, 6	DLBWP.0.1	
Initial UL BWP configuration		1, 2, 3, 4, 5, 6	ULBWP.0.1	
RLM-RS		1, 2, 3, 4, 5, 6	SSB	
Qrxlevmin	dBm/SCS	1, 2, 4, 5	-140	
		3, 6	-137	
Pcompensation	dB	1, 2, 3, 4, 5, 6	0	
$Qhyst_s$	dB	1, 2, 3, 4, 5, 6	0	
$Qoffset_{s, n}$	dB	1, 2, 3, 4, 5, 6	0	
Cell_selection_and_reselection_quality_measurement		1, 2, 3, 4, 5, 6	SS-RSRP	
$\hat{E}_s/I_{ot}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
N_{oc} Note2	dBm/SCS	1, 4	-98	
		2, 5	-98	
		3, 6	-95	
N_{oc} Note2	dBm/15 kHz	1, 4	-98	
		2, 5		
		3, 6		
$\hat{E}_s/N_{oc}$	dB	1, 4	-4	12
		2, 5		
		3, 6		
SS-RSRP Note3	dBm/SCS	1, 4	-102	-86
		2, 5	-102	-86
		3, 6	-99	-83
Io	dBm/9.36 MHz	1, 4	-68.60	-57.78
	dBm/9.36 MHz	2, 5	-68.60	-57.78
	dBm/38.16 MHz	3, 6	-62.50	-51.69
Treselection	s	1, 2, 3, 4, 5, 6	0	
Snonintrasearch	dB	1, 2, 3, 4, 5, 6	Not sent	
$Thresh_{x, high}$	dB	1, 2, 3, 4, 5, 6	48	
$Thresh_{serving, low}$	dB	1, 2, 3, 4, 5, 6	44	

$Thresh_{x,\ low}$	dB	1, 2, 3, 4, 5, 6	50
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN 3334 [Note 4]

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: The AWGN 3334 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 3334 Hz.

Table A.8.2.1.2.1-4: Cell specific test parameters for E-UTRA cell 1 in E-UTRA cell re-selection FR1 NR cell test case for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Cell 1	
		T1	T2
E-UTRA RF Channel number		1	
$BW_{channel}$	MHz	10	
OCNG Patterns defined in TS 36.133 clause A.3.2		OP.2 TDD for test configuration 1, 2, 3; OP.2 FDD for test configuration 4, 5, 6	
PBCH_RA	dB	0	
PBCH_RB	dB		
PSS_RA	dB		
SSS_RA	dB		
PCFICH_RB	dB		
PHICH_RA	dB		
PHICH_RB	dB		
PDCCH_RA	dB		
PDCCH_RB	dB		
PDSCH_RA	dB		
PDSCH_RB	dB		
OCNG_RA Note 1	dB		
OCNG_RB Note 1	dB		
Qrxlevmin	dBm	-140	
N_{oc} Note 2	dBm/15 kHz	-98	
RSRP Note 3	dBm/15 KHz	-84	-84
$\hat{E}_s/I_{ot}$	dB	14	14
$\hat{E}_s/N_{oc}$	dB	14	14
$Treselection_{EUTRAN}$	S	0	
Snonintrasearch	dB	50	
$Thresh_{x, high}$	dB	48	
$Thresh_{serving, low}$	dB	44	
$Thresh_{x, low}$	dB	50	
Propagation Condition		AWGN 1944 Hz Note4	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: RSRP levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: The AWGN 1944 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 1944 Hz.			

A.8.2.1.2.2 Test Requirements

The cell reselection delay to a lower priority NR cell is defined as the time from the beginning of time period T1, to the moment when the UE camps on cell 2, and starts to send preambles on the PRACH for sending the RRC CONNECTION REQUEST message to perform a Tracking Area Update procedure on cell 2.

The cell re-selection delay to a lower priority cell shall be less than 3 s.

The rate of correct cell reselections observed during repeated tests shall be at least 90%.

NOTE: The cell re-selection delay to a lower priority cell can be expressed as: $T_{evaluate, NR} + T_{SI-NR,}$

Where:

$T_{evaluate, NR}$ See Table 4.2.2.5.6-2 in clause 4.2.2.5.6 in [15]

T_{SI-NR} Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280 ms is assumed in this test case.

This gives a total of 2.24 s, allow 3 s for the cell re-selection delay to a lower priority NR cell.

A.8.3 RRC_CONNECTED state mobility

A.8.3.1 Handover

A.8.3.1.1 E-UTRAN - NR handover in FR1

A.8.3.1.1.1 Test Purpose and Environment

This test shall verify the E-UTRAN to NR FR1 handover requirements as specified in clause 6.1.2.1 specified in clause 5.3.4 in TS 36.133 [15].

The test comprises of one E-UTRA carrier and one NR carrier. There are two cells and one cell on each carrier. Cell 1 is the E-UTRAN and Cell 2 is an inter-RAT NR neighbour cell. The test consists of three successive time periods, with time durations of T1, T2 and T3 respectively. At the start of time duration T1, the UE does not have any timing information of Cell 2. Starting T2, Cell 2 becomes detectable and the UE is expected to detect and send a measurement report. Gap pattern configuration with id #0 as specified in Table 8.1.2.1-1 of TS 36.133 [15] is configured before T2 begins to enable inter-RAT frequency monitoring.

A RRC message implying handover shall be sent to the UE during period T2 after the UE has reported Event B2. The start of T3 is the instant when the last TTI containing the RRC message implying handover is sent to the UE. The handover message shall contain Cell 2 as the target cell.

Supported test configurations are shown in table A.8.3.1.1-1. General test parameters are provided in Table A.8.3.1.1-2. Cell specific test parameters for Cell 1 and Cell 2 are provided in Tables A.8.3.1.1-3 and A.8.3.1.1-4 respectively.

Table A.8.3.1.1-1: Supported test configurations for E-UTRAN inter-RAT NR handover

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.8.3.1.1-2: General test parameters for E-UTRAN inter-RAT NR handover

Parameter		Unit	Value	Comment
NR RF Channel Number			1	1 NR carrier frequency is used in the test
LTE RF Channel Number			2	1 E-UTRAN carrier frequency is used in the test
Initial conditions	Active cell		Cell 1	E-UTRAN cell
	Neighbouring cell		Cell 2	NR cell
Final condition	Active cell		Cell 2	
NR measurement quantity			SS-RSRP	
E-UTRAN measurement quantity			RSRP	
b2-Threshold1		dBm	-83	Absolute E-UTRAN RSRP threshold for event B2
b2-Threshold2NR		dBm	As specified in Table A.8.3.1.1-4	Absolute NR SS-RSRP threshold for event B2
Hysteresis		dB	0	
TimeToTrigger		s	0	
Filter coefficient			0	L3 filtering is not used
DRX			OFF	Non-DRX test
Access Barring Information		-	Not sent	No additional delays in random access procedure
Time offset between cells			3 ms	Asynchronous cells
Gap pattern configuration Id			0	As specified in Table 8.1.2.1-1 started before T2 starts [15]
T1		s	5	
T2		s	≤5	
T3		s	1	

Table A.8.3.1.1-3: Cell specific test parameters for E-UTRAN inter-RAT NR handover (Cell 1)

Parameter	Unit	Configuration	Cell 1		
			T1	T2	T3
RF channel number		1, 2, 3, 4, 5, 6	2		
Duplex mode		1, 2, 3	FDD		
		4, 5, 6	TDD		
TDD special subframe configuration[Note1]		4, 5, 6	6		
TDD uplink-downlink configuration[Note1]		4, 5, 6	1		
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100		
PRACH Configuration[Note2]		1, 2, 3	4		
		4, 5, 6	53		
PDSCH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD		
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD		
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note3]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD		
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD		
OCNG Patterns[Note3]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD		

			20 MHz: OP.17 FDD		
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD		
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0		
PBCH_RB					
PSS_RA					
SSS_RA					
PCFICH_RB					
PHICH_RA					
PHICH_RB					
PDCCH_RA					
PDCCH_RB					
PDSCH_RA					
PDSCH_RB					
OCNG_RA Note4					
OCNG_RB Note4					
N_{oc} Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-98		
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	7	7	7
$\hat{E}_s/I_{ot}$ Note6	dB	1, 2, 3, 4, 5, 6	7	7	7
RSRP Note6	dBm/15kHz	1, 2, 3, 4, 5, 6	-91	-91	-91
SCH_RP Note6	dBm/15kHz	1, 2, 3, 4, 5, 6	-91	-91	-91
Io Note6	dBm/9MHz	1, 2, 3, 4, 5, 6	-62.43	-62.43	-62.43
Propagation Condition		1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix Note7		1, 2, 3, 4, 5, 6	1x2 Low		

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2: PRACH configurations are specified in table 5.7.1-2 and table 5.7.1-3 in TS 36.211 [23].
Note 3: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 4: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 5: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 6: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 7: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.3.1.1-4: Cell specific test parameters E-UTRAN inter-RAT NR handover (Cell 2)

Parameter		Unit	Configuration	Cell 2		
				T1	T2	T3
RF channel number			1, 2, 3, 4, 5, 6	1		
Duplex mode			1, 4	FDD		
			2, 3, 5, 6	TDD		
TDD Configuration			2, 5	TDDConf.1.1		
			3, 6	TDDConf.1.2		
$BW_{channel}$		MHz	1, 4	10: $N_{RB,c}$ = 52 (FDD)		
			2, 5	10: $N_{RB,c}$ = 52 (TDD)		
			3, 6	40: $N_{RB,c}$ = 106 (TDD)		
PDSCH reference measurement channel			1, 4	SR.1.1 FDD		
			2, 5	SR.1.1 TDD		
			3, 6	SR.2.1 TDD		
CORSET reference channel			1, 4	CR.1.1 FDD		
			2, 5	CR.1.1 TDD		
			3, 6	CR.2.1 TDD		
PRACH configuration				FR1 PRACH configuration 1		
OCNG pattern[Note1]			1, 2, 3, 4, 5, 6	OP.1		
BWP	Initial DL BWP		1, 2, 3, 4, 5, 6	DLBWP.0.1		
	Dedicated DL BWP			DLBWP.1.1		
	Initial UL BWP			ULBWP.0.1		
	Dedicated UL BWP			ULBWP.1.1		
SMTC configuration			1, 2, 3, 4, 5, 6	SMTC.1		
SSB configuration			1, 2, 4, 5	SSB.1 FR1		
			3, 6	SSB.2 FR1		
b2-Threshold2NR		dBm	1, 2, 4, 5	-106		
			3, 6	-103		
EPRE ratio of PSS to SSS		dB	1, 2, 3, 4, 5, 6	0		
EPRE ratio of PBCH_DMRS to SSS						
EPRE ratio of PBCH to PBCH_DMRS						
EPRE ratio of PDCCH_DMRS to SSS						
EPRE ratio of PDCCH to PDCCH_DMRS						
EPRE ratio of PDSCH_DMRS to SSS						
EPRE ratio of PDSCH to PDSCH_DMRS						
EPRE ratio of OCNG DMRS to SSS						
EPRE ratio of OCNG to OCNG DMRS						
N_{oc} [Note2]		dBm/15 KHz	1, 2, 3, 4, 5, 6	-98		
N_{oc} [Note2]		dBm/SCS	1, 2, 4, 5	-98		
			3, 6	-95		
$\hat{E}_s/N_{oc}$		dB	1, 2, 3, 4, 5, 6	-inifinity	0	0
$\hat{E}_s/I_{ot}$ [Note3]		dB	1, 2, 3, 4, 5, 6	-inifinity	0	0
SS-RSRP[Note3]		dBm/SCS	1, 2, 4, 5	-inifinity	-98	-98
			3, 6	-inifinity	-95	-95
Io[Note3]		dBm/9.36 MHz	1, 2, 4, 5	-70.05	-67.04	-67.04
		dBm/38.16 MHz	3, 6	-63.96	-60.94	-60.94
Propagation condition			1, 2, 3, 4, 5, 6	AWGN		
Antenna Configuration and Correlation Matrix			1, 2, 3, 4, 5, 6	1x2 Low		

Note 1:	OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3:	$\hat{E}_s/I_{ot}$, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

A.8.3.1.1.2 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 85 ms from the beginning of time period T3.

The rate of correct handovers observed during repeated tests shall be at least 90%.

NOTE: The handover delay can be expressed as: RRC procedure delay + $T_{interrupt}$, where:

RRC procedure delay = 50 ms and is specified in TS36.331.

$T_{interrupt}$ = 62 ms in the test; $T_{interrupt}$ is defined in TS36.133 clause 5.3.4.3.

This gives a total of 112 ms.

A.8.4 Measurement procedure

A.8.4.1 E-UTRA – NR Inter-RAT SFTD Measurement Delay

A.8.4.1.1 E-UTRA – NR Inter-RAT SFTD Measurement Delay in non-DRX

A.8.4.1.1.1 Test Purpose and Environment

The purpose of this test is to partly verify that measurement reporting delay for SFTD between E-UTRA PCell and inter-RAT NR neighbour cell in FR1 is within the requirements stated in clauses 8.1.2.4.25 and 8.1.2.4.26 of TS 36.133 [15] for E-UTRA FDD and TDD, respectively, when no measurement gaps are provided and no DRX is configured.

The tests consist of a single time period of duration T1. Two carriers are used in the tests: one E-UTRA carrier with the PCell (Cell 1), and one NR carrier with the NR neighbour cell (Cell 2).

Prior to the start of time duration T1, the UE is connected to Cell 1 and configured to carry out intra-frequency measurements only. The point in time at which the UE receives, at the UE antenna connector(s), a RRC message containing a measurement configuration for SFTD measurements on RF channel 2 defines the start of time duration T1. Following the start of T1 the UE shall detect Cell 2, determine the SFN and frame time difference of Cell 2 relative to Cell 1, and send a measurement report.

The supported test configurations are listed in Table A.8.4.1.1.1-1 below. Test parameters and cell-specific parameters for the NR cell are provided in Tables A.8.4.1.1.1-2 and A.8.4.1.1.1-3 below, respectively. Cell-specific parameters for the E-UTRA cell are provided in Table A.3.7.2.1-1 in clause A.3.7.2.1.

Table A.8.4.1.1.1-1: Applicable E-UTRA and NR configurations for inter-RAT SFTD measurement delay test

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.8.4.1.1.1-2: Applicable E-UTRA and NR configurations for inter-RAT SFTD measurement delay test

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1		One NR FR1 carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	Cell 1		Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	Cell 2		Cell 2 is on NR RF channel number 1.
SMTC-SSB parameters		Config 1,4	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1		As specified in clause A.3.10.1
CP length		Config 1,2,3,4,5,6	Normal		Applicable to both cells.
DRX		Config 1,2,3,4,5,6	OFF		DRX is not used
Frame time offset between serving and neighbour cells	ms	Config 1,2,3,4	3	7	Asynchronous cells. The timing of Cell 2 relative to the timing of Cell 1.
	μs	Config 5,6	3		Synchronous cells.
SFN offset between serving and neighbour cells		Config 1,2,3,4,5,6	0	1	SFN of Cell 2 relative to SFN of Cell 1.
T1	s	Config 1,2,3,4,5,6	1		

Table A.8.4.1.1.1-3: Cell specific test parameters for Cell 2 in inter-RAT SFTD measurement delay test

Parameter	Unit	Test configuration	Cell 2
NR RF Channel Number		Config 1,2,3,4,5,6	1
Duplex mode		Config 1,4	FDD
		Config 2,3,5,6	TDD
$BW_{channel}$	MHz	Config 1,4	10: $N_{RB,c}$ = 52
		Config 2,5	10: $N_{RB,c}$ = 52
		Config 3,6	40: $N_{RB,c}$ = 106
TDD configuration		Config 2,5	TDDConf.1.1
		Config 3,6	TDDConf.2.1
OCNG Pattern defined in A.3.2.1.1		Config 1,2,3,4,5,6	OP.1
SMTC configuration defined in A.3.2.11.1 and A.3.2.11.2		Config 1,4	SMTC.2
		Config 2,3,5,6	SMTC.1
PDSCH/PDCCH subcarrier spacing	kHz	Config 1,2,4,5	15
		Config 3,6	30
EPRE ratio of PSS to SSS	dB	Config 1,2,3,4,5,6	0
EPRE ratio of PBCH DMRS to SSS	dB		
EPRE ratio of PBCH to PBCH DMRS	dB		
EPRE ratio of OCNG DMRS to SSS Note 1	dB		
EPRE ratio of OCNG to OCNG DMRS Note 1	dB		
N_{oc} Note2	dBm/15kHz		-98
N_{oc} Note2	dBm/SCS	Config 1,2,4,5	-98
		Config 3,6	-95
SS-RSRP Note 3, 4	dBm/SCS	Config 1,2,4,5	-94
		Config 3,6	-91
$\hat{E}_s/I_{ot}$	dB	Config 1,2,3,4,5,6	4
$\hat{E}_s/N_{oc}$	dB	Config 1,2,3,4,5,6	4
Io Note 3	dBm/9.36MHz	Config 1,2,4,5	-64.59
	dBm/38.16MHz	Config 3,6	-58.50
Propagation Condition		Config 1,2,3,4,5,6	AWGN
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.			

A.8.4.1.1.2 Test Requirements

Following the start of T1, the UE shall detect Cell 2 and determine the relative time difference between Cell 1 and Cell 2. At latest at $T_{RRC\_procedure\_delay} + T_{measure\_SFTD1}$ after the beginning of time duration T1, the UE shall send a measurement report on SFTD between Cell 1 and Cell 2.

The observed rate of successful SFTD reports in repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2 \times TTI_{DCCH}$ longer than the measurement reporting delays above due to TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.1.2 E-UTRA – NR Inter-RAT SFTD Measurement Delay in DRX

A.8.4.1.2.1 Test Purpose and Environment

The purpose of this test is to partly verify that measurement reporting delay for SFTD between E-UTRA PCell and inter-RAT NR neighbour cell in FR1 is within the requirements stated in clauses 8.1.2.4.25 and 8.1.2.4.26 of TS 36.133 [15] for E-UTRA FDD and TDD, respectively, when no measurement gaps are provided and DRX is configured.

The tests consist of a single time period of duration T1. Two carriers are used in the tests: one E-UTRA carrier with the PCell (Cell 1), and one NR carrier with the NR neighbour cell (Cell 2).

Prior to the start of time duration T1, the UE is connected to Cell 1 and configured to carry out intra-frequency measurements only. The point in time at which the UE receives, at the UE antenna connector(s), a RRC message containing a measurement configuration for SFTD measurements on RF channel 2 defines the start of time duration T1. Following the start of T1 the UE shall detect Cell 2, determine the SFN and frame time difference of Cell 2 relative to Cell 1, and send a measurement report.

The supported test configurations are listed in Table A.8.4.1.2.1-1 below. Test parameters are provided in Tables A.8.4.1.2.1-2 below. Cell-specific parameters for the E-UTRA and NR cells are provided in Table A.3.7.2.1-1 in clause A.3.7.2.1, and Table A.8.4.1.1.1-3 in clause A.8.4.1.1.1, respectively.

Table A.8.4.1.2.1-1: Applicable E-UTRA and NR configurations for inter-RAT SFTD measurement delay test in DRX

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.8.4.1.2.1-2: Applicable E-UTRA and NR configurations for inter-RAT SFTD measurement delay test in DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		Config 1,2,3,4,5,6	1		One E-UTRAN carrier frequencies is used.
NR RF Channel Number		Config 1,2,3,4,5,6	1		One NR FR1 carrier frequencies is used.
Active cell		Config 1,2,3,4,5,6	Cell 1		Cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		Config 1,2,3,4,5,6	Cell 2		Cell 2 is on NR RF channel number 1.
SMTC-SSB parameters		Config 1,4	SSB.1 FR1		As specified in clause A.3.10.1
		Config 2,5	SSB.1 FR1		As specified in clause A.3.10.1
		Config 3,6	SSB.2 FR1		As specified in clause A.3.10.1
CP length		Config 1,2,3,4,5,6	Normal		Applicable to both cells.
DRX		Config 1,2,3,4,5,6	DRX.4		DRX configuration as specified in clause A.3.3.4
Frame time offset between serving and neighbour cells	ms	Config 1,2,3,4	3	7	Asynchronous cells. The timing of Cell 2 relative to the timing of Cell 1.
	µs	Config 5,6	3		Synchronous cells.
SFN offset between serving and neighbour cells		Config 1,2,3,4,5,6	0	1	SFN of Cell 2 relative to SFN of Cell 1.
T1	s	Config 1,2,3,4,5,6	1		

A.8.4.1.2.2 Test Requirements

Following the start of T1, the UE shall detect Cell 2 and determine the relative time difference between Cell 1 and Cell 2. At latest at the earliest DRX activity time following upon $T_{RRC\_procedure\_delay} + T_{measure\_SFTD1}$ from the beginning of time duration T1, the UE shall send a measurement report on SFTD between Cell 1 and Cell 2.

The observed rate of successful SFTD reports in repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to $2\times TTI_{DCCH}$ longer than the measurement reporting delays above due to TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2 E-UTRA – NR Inter-RAT Measurements

A.8.4.2.1 NR Inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is not used

A.8.4.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in Tables A.8.4.2.1.1-1, A.8.4.2.1.1-2, A.8.4.2.1.1-3 and A.8.4.2.1.1-4.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.8.4.2.1.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.8.4.2.1.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.1.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.1.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1		One E-UTRAcarrier frequency is used.
NR RF Chanel Number		1, 2, 3, 4, 5, 6	1		One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2		NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0	4	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39	19	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1		E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2		SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0		
CP length		1, 2, 3, 4, 5, 6	Normal		
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0		
Filter coefficient		1, 2, 3, 4, 5, 6	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	OFF		DRX is not used
Time offset between serving and neighbour cells		1, 4	3ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2, 3, 5, 6	3μs		Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5		
T2	s	1, 2, 3, 4, 5, 6	1	1	
Note 1: The value of b2-Threshold1 is defined in Table A.8.4.2.1.1-3 Note 2: The value of b2-Threshold2NR is defined in Table A.8.4.2.1.1-4					

Table A.8.4.2.1.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50	

			20 MHz: $N_{RB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel Note2		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note2		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns Note2		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA Note3				
OCNG_RB Note3				
N_{oc} Note4	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$ Note5	dB	1, 2, 3, 4, 5, 6	17	17
RSRP Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP Note5	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io Note5	dBm/9MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{RB,c}$ /50)	-59.13+10log ($N_{RB,c}$ /50)
Propagation Condition Note6		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix Note6		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.2.1.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{RB,c}$ = 52	
		3, 6	40: $N_{RB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.1.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 800 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and test 2, the UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.2 NR Inter-RAT event triggered reporting tests for FR1 without SSB time index detection when DRX is used

A.8.4.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in Tables A.8.4.2.2.1-1, A.8.4.2.2.1-2, A.8.4.2.2.1-3 and A.8.4.2.2.1-4.

In tests 1 and 2, measurement gap pattern configuration # 0 as defined in Table A.8.4.2.2.1-2 is provided for UE that does not support per-FR gap and in tests 3 and 4, measurement gap pattern configuration #4 as defined in Table A.8.4.2.2.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.2.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.2.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 2	Test 4	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1				One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6	1				One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)				E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2				NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0		4		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39		19		As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1				E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2				SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0				
CP length		1, 2, 3, 4, 5, 6	Normal				
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0				
Filter coefficient		1, 2, 3, 4, 5, 6	0				L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.9	DRX.10	DRX.9	DRX.10	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 4	3ms				Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2, 3, 5, 6	3µs				Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5				
T2	s	1, 2, 3, 4, 5, 6	2	11	2	11	
Note 1: The value of b2-Threshold1 is defined in Table A.8.4.2.2.1-3 Note 2: The value of b2-Threshold2NR is defined in Table A.8.4.2.2.1-4							

Table A.8.4.2.2.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	

TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	17	17
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io[Note5]	dBm/9MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{RB,c}$ /50)	-59.13+10log ($N_{RB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6	1x2 Low	
Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23]. Note 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively. Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].				

Table A.8.4.2.2.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{RB,c}$ = 52	
		3, 6	40: $N_{RB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.2.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-FR gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1080 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 10240 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In tests 1, 2, 3 and 4, the UE is not required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.3 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is not used

A.8.4.2.3.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in Tables A.8.4.2.3.1-1, A.8.4.2.3.1-2, A.8.4.2.3.1-3 and A.8.4.2.3.1-4.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.8.4.2.3.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.8.4.2.3.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.3.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.3.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1		One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6	1		One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2		NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0	4	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39	19	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1		E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2		SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0		
CP length		1, 2, 3, 4, 5, 6	Normal		
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0		
Filter coefficient		1, 2, 3, 4, 5, 6	0		L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	OFF		DRX is not used
Time offset between serving and neighbour cells		1, 4	3ms		Asynchronous cells. The timing of Cell 2 is 3 ms later than the timing of Cell 1.
		2, 3, 5, 6	3µs		Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5		
T2	s	1, 2, 3, 4, 5, 6	2	1	
Note 1: The value of b2-Threshold1 is defined in Table A.8.4.2.3.1-3 Note 2: The value of b2-Threshold2NR is defined in Table A.8.4.2.3.1-4					

Table A.8.4.2.3.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	17	17
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io[Note5]	dBm/9MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{RB,c}$ /50)	-59.13+10log ($N_{RB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6	1x2 Low	
Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23]. Note 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.				

Note 3:	OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5:	$\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 6:	Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.2.3.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{RB,c}$ = 52	
		3, 6	40: $N_{RB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.3.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1040 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 920 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and test 2, the UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.4 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection when DRX is used

A.8.4.2.4.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in Tables A.8.4.2.4.1-1, A.8.4.2.4.1-2, A.8.4.2.4.1-3 and A.8.4.2.4.1-4.

In tests 1 and 2, measurement gap pattern configuration # 0 as defined in Table A.8.4.2.4.1-2 is provided for UE that does not support per-FR gap and in tests 3 and 4, measurement gap pattern configuration #4 as defined in Table A.8.4.2.4.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.4.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR1

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.4.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 2	Test 4	
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1				One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6	1				One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)				E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2				NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0		4		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39		19		As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1				E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2				SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0				
CP length		1, 2, 3, 4, 5, 6	Normal				
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0				
Filter coefficient		1, 2, 3, 4, 5, 6	0				L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.9	DRX.10	DRX.9	DRX.10	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 4	3ms				Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2, 3, 5, 6	3µs				Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5				
T2	s	1, 2, 3, 4, 5, 6	2	13	2	13	
Note 1: The value of b2-Threshold1 is defined in Table A.8.4.2.4.1-3 Note 2: The value of b2-Threshold2NR is defined in Table A.8.4.2.4.1-4							

Table A.8.4.2.4.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting in non-DRX with NR neigbour cell in FR1 without SSB time index detection

Parameter	Unit	Configuration	Cell 1	
			T1	T2
RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	

TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-77	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	17	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	17	17
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-87	-87
Io[Note5]	dBm/9MHz	1, 2, 3, 4, 5, 6	-59.13+10log ($N_{RB,c}$ /50)	-59.13+10log ($N_{RB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5: $\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 6: Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.2.4.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 without SSB time index detection

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{RB,c}$ = 52	
		3, 6	40: $N_{RB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-101	
		3, 6	-98	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36MHz	1, 2, 4, 5	-70.05	-62.26
	dBm/38.16MHz	3, 6	-63.95	-56.16
Propagation Condition		1, 2, 3, 4, 5, 6	ETU70	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.

Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.

Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.4.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 12160 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-FR gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 1280 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 12160 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In tests 1, 2, 3 and 4, the UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.5 NR Inter-RAT event triggered reporting tests for FR2 without SSB time index detection when DRX is not used

A.8.4.2.5.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in Tables A.8.4.2.5.1-1, A.8.4.2.5.1-2 and A.8.4.2.5.1-3.

The cell specific test parameters for E-UTRA cell1 as PCell are defined in clause A.3.7.2.2.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.8.4.2.5.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.8.4.2.5.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have timing information of NR cell 2.

Table A.8.4.2.5.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR2 in non-DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.5.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Number		1, 2	1		One E-UTRAcarrier frequency is used.
NR RF Channel Number		1, 2	1		One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA cell 1 (PCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR cell 2		NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0	4	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39	19	As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1		SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
Hysteresis	dB	1, 2	0		
CP length		1, 2	Normal		
TimeToTrigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	OFF		DRX is not used
Time offset between serving and neighbour cells		1	3ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3μs		Synchronous cells.
T1	s	1, 2	10		
T2	s	1, 2	6	3	
Note 1: The value of b1-ThresholdNR is defined in Table A.8.4.2.5.1-3					

Table A.8.4.2.5.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Parameter		Unit	Test configuration	Cell 2	
				T1	T2
AoA setup defined in A.3.15.2.1			1, 2	Setup 2a	
NR RF Channel Number			1, 2	1	
Duplex mode			1, 2	TDD	
TDD configuration			1, 2	TDDConf.3.1	
$BW_{channel}$		MHz	1, 2	100: $N_{RB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1 (OP.1)			1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2			1	SMTC.2	
			2	SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	1, 2	120	
b1-ThresholdNR	UE power class 3	dBm/SCS	1, 2	-108	
EPRE ratio of PSS to SSS			1, 2	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS (Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2		dBm/15kHz	1, 2	-111	
N_{oc} Note2		dBm/SCS	1, 2	-102	
SS-RSRP Note 3		dBm/SCS	1, 2	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	1, 2	-Infinity	14
$\hat{E}_s/N_{oc}$		dB	1, 2	-Infinity	14
Io Note3		dBm/95.04MHz	1, 2	-Infinity	-58.84
Propagation Condition			1, 2	AWGN	

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.5.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D2 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and test 2, the UE is not required to report SSB time index.

Table A.8.4.2.5.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in non-DRX

Test case	Measurement reporting delay (ms)	
	Test 1: D1 ms	Test 2: D2 ms
UE power class 3	3200	1600

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.6 NR Inter-RAT event triggered reporting tests for FR2 without SSB time index detection when DRX is used

A.8.4.2.6.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in Tables A.8.4.2.6.1-1, A.8.4.2.6.1-2 and A.8.4.2.6.1-3.

The cell specific test parameters for E-UTRA cell1 as PCell are defined in clause A.3.7.2.2.

In tests 1 and 2, measurement gap pattern configuration # 0 as defined in Table A.8.4.2.6.1-2 is provided for UE that does not support per-FR gap and in tests 3 and 4, measurement gap pattern configuration #4 as defined in Table A.8.4.2.6.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have timing information of NR cell 2.

Table A.8.4.2.6.1-1: NR inter-RAT event triggered reporting tests without SSB index reading for FR2 in DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.6.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in DRX

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		1, 2	1				One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2	1				One FR2 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)				E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2				NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0		4		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39		19		As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1				SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0				
CP length		1, 2, 3, 4, 5, 6	Normal				
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0				
Filter coefficient		1, 2, 3, 4, 5, 6	0				L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.9	DRX.10	DRX.9	DRX.10	As specified in clause A.3.3
Time offset between serving and neighbour cells		1	3ms				Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3µs				Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5				
T2	s	1, 2, 3, 4, 5, 6	6	83	6	83	
Note 1: The value of b1-ThresholdNR is defined in Table A.8.4.2.5.1-3							

Table A.8.4.2.6.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in DRX

Parameter		Unit	Test configuration	Cell 2	
				T1	T2
AoA setup defined in A.3.15.1			1, 2	Setup 1	
NR RF Channel Number			1, 2	1	
Duplex mode			1, 2	TDD	
TDD configuration			1, 2	TDDConf.3.1	
$BW_{channel}$		MHz	1, 2	100: $N_{RB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1 (OP.1)			1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2			1	SMTC.2	
			2	SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	1, 2	120	
b1-ThresholdNR	UE power class 3	dBm/SCS	1, 2	-96	
EPRE ratio of PSS to SSS			1, 2	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS (Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2		dBm/15kHz	1, 2	-111	
N_{oc} Note2		dBm/SCS	1, 2	-102	
SS-RSRP Note 3		dBm/SCS	1, 2	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	1, 2	-Infinity	14
$\hat{E}_s/N_{oc}$		dB	1, 2	-Infinity	14
Io Note3		dBm/95.04MHz	1, 2	-Infinity	-58.84
Propagation Condition			1, 2	AWGN	

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.6.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D2 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-FR gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D3 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event B1 triggered measurement report, with a measurement reporting delay less than D4 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In tests 1, 2, 3 and 4, the UE is not required to report SSB time index.

Table A.8.4.2.6.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 without SSB time index detection in DRX

Test case	Measurement reporting delay (ms)			
	Test 1: D1 ms	Test 2: D2 ms	Test 3: D3 ms	Test 4: D4 ms
UE power class 3	4800	51200	4800	51200

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.7 NR Inter-RAT event triggered reporting tests for FR2 with SSB time index detection when DRX is not used

A.8.4.2.7.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in Tables A.8.4.2.7.1-1, A.8.4.2.7.1-2 and A.8.4.2.7.1-3.

The cell specific test parameters for E-UTRA cell1 as PCell are defined in clause A.3.7.2.2.

In test 1 measurement gap pattern configuration # 0 as defined in Table A.8.4.2.7.1-2 is provided for UE that does not support per-FR gap and in test 2 measurement gap pattern configuration #4 as defined in Table A.8.4.2.7.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.7.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR2 in non-DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.7.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in non-DRX

Parameter	Unit	Test configuration	Value		Comment
			Test 1	Test 2	
E-UTRA RF Channel Numbers		1, 2	1		One E-UTRA carrier frequency is used.
NR RF Channel Numbers		1, 2	1		One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA cell 1 (PCell)		E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR cell 2		NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0	4	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39	19	As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1		SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
Hysteresis	dB	1, 2	0		
CP length		1, 2	Normal		
TimeToTrigger	s	1, 2	0		
Filter coefficient		1, 2	0		L3 filtering is not used
DRX		1, 2	OFF		DRX is not used
Time offset between serving and neighbour cells		1	3ms		Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3μs		Synchronous cells.
T1	s	1, 2	5		
T2	s	1, 2	5	3	
Note 1: The value of b1-ThresholdNR is defined in Table A.8.4.2.5.1-3					

Table A.8.4.2.7.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in non-DRX

Parameter		Unit	Test configuration	Cell 2	
				T1	T2
AoA setup defined in A.3.15.1			1, 2	Setup 1	
NR RF Channel Number			1, 2	1	
Duplex mode			1, 2	TDD	
TDD configuration			1, 2	TDDConf.3.1	
$BW_{channel}$		MHz	1, 2	100: $N_{RB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1 (OP.1)			1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2			1	SMTC.2	
			2	SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	1, 2	120	
b1-ThresholdNR	UE power class 3	dBm/SCS	1, 2	-96	
EPRE ratio of PSS to SSS			1, 2	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS (Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2		dBm/15kHz	1, 2	-111	
N_{oc} Note2		dBm/SCS	1, 2	-102	
SS-RSRP Note 3		dBm/SCS	1, 2	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	1, 2	-Infinity	14
$\hat{E}_s/N_{oc}$		dB	1, 2	-Infinity	14
Io Note3		dBm/95.04MHz	1, 2	-Infinity	-58.84
Propagation Condition			1, 2	AWGN	

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.7.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-FR gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than D2 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 1 and test 2, the UE is required to report SSB time index.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

Table A.8.4.2.7.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in non-DRX

Test case	Measurement reporting delay (ms)	
	Test 1: D1 ms	Test 2: D2 ms
UE power class 3	4160	2080

A.8.4.2.8 NR Inter-RAT event triggered reporting tests for FR2 with SSB time index detection when DRX is used

A.8.4.2.8.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21 of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR2 on NR RF channel 1. The test parameters are given in Tables A.8.4.2.8.1-1, A.8.4.2.8.1-2 and A.8.4.2.8.1-3.

The cell specific test parameters for E-UTRA cell1 as PCell are defined in clause A.3.7.2.2.

In tests 1 and 2, measurement gap pattern configuration # 0 as defined in Table A.8.4.2.8.1-2 is provided for UE that does not support per-FR gap and in tests 3 and 4, measurement gap pattern configuration #4 as defined in Table A.8.4.2.8.1-2 is provided for UE that supports per-FR gap.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B1 (Inter RAT neighbour becomes better than threshold) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.8.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR2 in DRX

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.8.1-2: General test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in DRX

Parameter	Unit	Test configuration	Value				Comment
			Test 1	Test 2	Test 3	Test 4	
E-UTRA RF Channel Number		1, 2	1				One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2	1				One FR2 NR carrier frequency is used.
Active cell		1, 2	E-UTRA cell 1 (PCell)				E-UTRA cell 1 is on E-UTRA RF channel number 1 as defined in clause A.3.7.2.2.
Neighbour cell		1, 2	NR cell 2				NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2	0		4		As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2	39		19		As specified in TS 36.331 [16].
b1-ThresholdNR	dBm	1, 2	Note 1				SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B1 [16]
Hysteresis	dB	1, 2	0				
CP length		1, 2	Normal				
TimeToTrigger	s	1, 2	0				
Filter coefficient		1, 2	0				L3 filtering is not used
DRX			DRX.9	DRX.10	DRX.9	DRX.10	As specified in clause A.3.3
Time offset between serving and neighbour cells		1	3ms				Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2	3μs				Synchronous cells.
T1	s	1, 2	5				
T2	s	1, 2	7	70	7	70	
Note 1: The value of b1-ThresholdNR is defined in Table A.8.4.2.5.1-3							

Table A.8.4.2.8.1-3: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR2 with SSB time index detection

Parameter		Unit	Test configuration	Cell 2	
				T1	T2
AoA setup defined in A.3.15.1			1, 2	Setup 1	
NR RF Channel Number			1, 2	1	
Duplex mode			1, 2	TDD	
TDD configuration			1, 2	TDDConf.3.1	
$BW_{channel}$		MHz	1, 2	100: $N_{RB,c}$ = 66	
OCNG patterns defined in A.3.2.1.1 (OP.1)			1, 2	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2			1	SMTC.2	
			2	SMTC.1	
PDSCH/PDCCH subcarrier spacing		kHz	1, 2	120	
b1-ThresholdNR	UE power class 3	dBm/SCS	1, 2	-96	
EPRE ratio of PSS to SSS			1, 2	0	
EPRE ratio of PBCH DMRS to SSS					
EPRE ratio of PBCH to PBCH DMRS					
EPRE ratio of PDCCH DMRS to SSS					
EPRE ratio of PDCCH to PDCCH DMRS					
EPRE ratio of PDSCH DMRS to SSS					
EPRE ratio of PDSCH to PDSCH					
EPRE ratio of OCNG DMRS to SSS (Note 1)					
EPRE ratio of OCNG to OCNG DMRS (Note 1)					
N_{oc} Note2		dBm/15kHz	1, 2	-111	
N_{oc} Note2		dBm/SCS	1, 2	-102	
SS-RSRP Note 3		dBm/SCS	1, 2	-Infinity	-88
$\hat{E}_s/I_{ot}$		dB	1, 2	-Infinity	14
$\hat{E}_s/N_{oc}$		dB	1, 2	-Infinity	14
Io Note3		dBm/95.04MHz	1, 2	-Infinity	-58.84
Propagation Condition			1, 2	AWGN	
Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.					

A.8.4.2.8.2 Test Requirements

In test 1 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than D1 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 2 with per-UE gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than D2 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 3 with per-FR gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than D3 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In test 4 with per-FR gap, the UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than D4 ms from the beginning of time period T2. The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled. The rate of correct events observed during repeated tests shall be at least 90%.

In tests 1, 2, 3 and 4, the UE is required to report SSB time index.

Table A.8.4.2.8.2-1: Test requirements for NR inter-RAT event triggered reporting for FR2 with SSB time index detection in DRX

Test case	Measurement reporting delay (ms)			
	Test 1: D1 ms	Test 2: D2 ms	Test 3: D3 ms	Test 4: D4 ms
UE power class 3	6240	66560	6240	66560

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.4.2.9 NR Inter-RAT event triggered reporting tests for FR1 with SSB time index detection in DRX for UE configured with highSpeedInterRAT-NR-r16

A.8.4.2.9.1 Test Purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the NR inter-RAT cell search requirements in clause 8.1.2.4.21of TS 36.133 [15] for E-UTRAN FDD-NR measurements and clause 8.1.2.4.22 of TS 36.133 [15] for E-UTRAN TDD-NR measurements when UE is configured with *highSpeedInterRAT-NR-r16*.

In this test, there are two cells: E-UTRA cell 1 as PCell on E-UTRA RF channel 1 and NR cell 2 as neighbour cell in FR1 on NR RF channel 1. The test parameters are given in Tables A.8.4.2.9.1-1, A.8.4.2.9.1-2, A.8.4.2.9.1-3 and A.8.4.2.9.1-4.

In the measurement control information, it is indicated to the UE that event-triggered reporting with Event B2 (PCell becomes worse than threshold1 and inter RAT neighbour becomes better than threshold2) [16] is used. In the measurement configuration the UE shall be indicated to report the SSB index of the identified NR cell. The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of NR cell 2.

Table A.8.4.2.9.1-1: NR inter-RAT event triggered reporting tests with SSB index reading for FR1 for UE configured with highSpeedInterRAT-NR-r16

Configuration	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note 1: The UE is only required to be tested in one of the supported test configurations.	

Table A.8.4.2.9.1-2: General test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Test configuration	Value	Comment
E-UTRA RF Channel Number		1, 2, 3, 4, 5, 6	1	One E-UTRA carrier frequency is used.
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	One FR1 NR carrier frequency is used.
Active cell		1, 2, 3, 4, 5, 6	E-UTRA cell 1 (PCell)	E-UTRA cell 1 is on E-UTRA RF channel number 1.
Neighbour cell		1, 2, 3, 4, 5, 6	NR cell 2	NR cell 2 is on NR RF channel number 1.
Gap Pattern Id		1, 2, 3, 4, 5, 6	0	As specified in clause Table 8.1.2.1-1 of TS 36.133 [15].
Measurement gap offset		1, 2, 3, 4, 5, 6	39	As specified in TS 36.331 [16].
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	Note 1	E-UTRA RSRP threshold for E-UTRA RSRP measurement on cell 1 for event B2 [16]
b2-Threshold2NR	dBm	1, 2, 3, 4, 5, 6	Note 2	SS-RSRP threshold for SS-RSRP measurement on cell 2 for event B2 [16]
Hysteresis	dB	1, 2, 3, 4, 5, 6	0	
CP length		1, 2, 3, 4, 5, 6	Normal	
TimeToTrigger	s	1, 2, 3, 4, 5, 6	0	
Filter coefficient		1, 2, 3, 4, 5, 6	0	L3 filtering is not used
DRX		1, 2, 3, 4, 5, 6	DRX.6	As specified in clause A.3.3
Time offset between serving and neighbour cells		1, 4	3ms	Asynchronous cells. The timing of Cell 2 is 3ms later than the timing of Cell 1.
		2, 3, 5, 6	3µs	Synchronous cells.
T1	s	1, 2, 3, 4, 5, 6	5	
T2	s	1, 2, 3, 4, 5, 6	5	
Note 1: The value of b2-Threshold1 is defined in Table A.8.4.2.9.1-3 Note 2: The value of b2-Threshold2NR is defined in Table A.8.4.2.9.1-4				

Table A.8.4.2.9.1-3: E-UTRAN PCell specific test parameters for NR inter-RAT event triggered reporting with NR neigbour cell in FR1 with SSB time index detection for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Configuration	Cell 1	
			T1	T2

RF channel number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 2, 3	FDD	
		4, 5, 6	TDD	
TDD special subframe configuration[Note1]		4, 5, 6	6	
TDD uplink-downlink configuration[Note1]		4, 5, 6	1	
$BW_{channel}$	MHz	1, 2, 3, 4, 5, 6	5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100	
PDSCH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD	
		4, 5, 6	5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD	
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel[Note2]		1, 2, 3	5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD	
		4, 5, 6	5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD	
OCNG Patterns[Note2]		1, 2, 3	5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD	
		4, 5, 6	5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD	
b2-Threshold1	dBm	1, 2, 3, 4, 5, 6	-79	
PBCH_RA	dB	1, 2, 3, 4, 5, 6	0	
PBCH_RB				
PSS_RA				
SSS_RA				
PCFICH_RB				
PHICH_RA				
PHICH_RB				
PDCCH_RA				
PDCCH_RB				
PDSCH_RA				
PDSCH_RB				
OCNG_RA[Note3]				
OCNG_RB[Note3]				
N_{oc}[Note4]	dBm/15kHz	1, 2, 3, 4, 5, 6	-104	
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	6	17
$\hat{E}_s/I_{ot}$[Note5]	dB	1, 2, 3, 4, 5, 6	6	17
RSRP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	-87
SCH_RP[Note5]	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	-87
Io[Note5]	dBm/9MHz	1, 2, 3, 4, 5, 6	-69.25+10log ($N_{RB,c}$ /50)	-59.13+10log ($N_{RB,c}$ /50)
Propagation Condition [Note6]		1, 2, 3, 4, 5, 6	AWGN	
Antenna Configuration and Correlation Matrix [Note6]		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1:	Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2:	DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3:	OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4:	Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5:	$\hat{E}_s/I_{ot}$, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 6:	Propagation condition and correlation matrix are defined in clause B.2 in TS 36.101 [25].

Table A.8.4.2.9.1-4: NR neighbour cell specific test parameters for NR inter-RAT event triggered reporting for FR1 with SSB time index detection for UE configured with highSpeedInterRAT-NR-r16

Parameter	Unit	Test configuration	Cell 2	
			T1	T2
NR RF Channel Number		1, 2, 3, 4, 5, 6	1	
Duplex mode		1, 4	FDD	
		2, 3, 5, 6	TDD	
TDD configuration		2, 5	TDDConf.1.1	
		3, 6	TDDConf.2.1	
$BW_{channel}$	MHz	1, 2, 4, 5	10: $N_{RB,c}$ = 52	
		3, 6	40: $N_{RB,c}$ = 106	
OCNG Patterns defined in A.3.2.1.1 (OP.1)		1, 2, 3, 4, 5, 6	OP.1	
SMTC configuration defined in A.3.11.1 and A.3.11.2		1, 4	SMTC.2	
		2, 3, 5, 6	SMTC.1	
PDSCH/PDCCH subcarrier spacing	kHz	1, 2, 4, 5	15	
		3, 6	30	
b2-Threshold2NR	dBm/SCS	1, 2, 4, 5	-99	
		3, 6	-96	
EPRE ratio of PSS to SSS		1, 2, 3, 4, 5, 6	0	
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH				
EPRE ratio of OCNG DMRS to SSS (Note 1)				
EPRE ratio of OCNG to OCNG DMRS (Note 1)				
N_{oc} Note2	dBm/15kHz	1, 2, 3, 4, 5, 6	-98	
N_{oc} Note2	dBm/SCS	1, 2, 4, 5	-98	
		3, 6	-95	
SS-RSRP Note 3	dBm/SCS	1, 2, 4, 5	-Infinity	-91
		3, 6	-Infinity	-88
$\hat{E}_s/I_{ot}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
$\hat{E}_s/N_{oc}$	dB	1, 2, 3, 4, 5, 6	-Infinity	7
Io Note3	dBm/9.36MHz	1, 2, 4, 5	-Infinity	-65.38
	dBm/38.16MHz	3, 6	-Infinity	-61.06
Propagation Condition		1, 2, 4, 5	AWGN1944	
		3,6	AWGN3334	
Antenna Configuration and Correlation Matrix		1, 2, 3, 4, 5, 6	1x2 Low	

Note 1: OCNG shall be used such that the cell is fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.

A.8.4.2.9.2 Test Requirements

The UE shall send one Event B2 triggered measurement report, with a measurement reporting delay less than 4.8s from the beginning of time period T2. The UE is required to read the neighbour cell SSB index and report the acquired SSB index in this test.

NOTE: The actual overall delays measured in the test may be up to $2xTTI_{DCCH}$ higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

A.8.5 Measurement performance

A.8.5.1 SFTD accuracy

A.8.5.1.1 SFTD accuracy

A.8.5.1.1.1 Test Purpose

The purpose of this set of tests is to verify that the SFTD measurement accuracy is within the specified limits. This test will verify the requirements as specified in clause 9.1.27 in TS 36.133 [15] for inter-RAT FR1 SFTD measurements.

A.8.5.1.1.2 Test Environment

Supported test configurations are shown in Table A.8.5.1.1.2-1. In this set of test cases there are two cells on different carriers. Cell 1 is E-UTRAN PCell and Cell 2 is inter-RAT NR FR1 target cell. The test parameters of cell 1 are given in clause A.8.5.1.1.2-2. The test parameters of cell 2 are given in Table A.8.5.1.1.2-3. The SFTD between PCell and target cell shall be set by the test equipment to one of the time differences in Table A.8.5.1.1.2-4.

Table A.8.5.1.1.2-1: Supported test configurations for SFTD accuracy

Configuration	Description
1	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE FDD
2	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE FDD
3	NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE FDD
4	NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode, LTE TDD
5	NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode, LTE TDD
6	NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode, LTE TDD
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.8.5.1.1.2-2: Test parameters for SFTD accuracy (Cell 1)

Parameter	Unit	Test 1
E-UTRA RF Channel Number		1
Duplex mode		FDD or TDD
TDD special subframe configuration Note1		6
TDD uplink-downlink configuration Note1		1
$BW_{channel}$		5 MHz: $N_{RB,c}$ = 25 10 MHz: $N_{RB,c}$ = 50 20 MHz: $N_{RB,c}$ = 100
PDSCH parameters: DL Reference Measurement Channel Note2		5 MHz: R.7 FDD 10 MHz: R.3 FDD 20 MHz: R.6 FDD 5 MHz: R.4 TDD 10 MHz: R.0 TDD 20 MHz: R.3 TDD
PCFICH/PDCCH/PHICH parameters: DL Reference Measurement Channel Note2		5 MHz: R.11 FDD 10 MHz: R.6 FDD 20 MHz: R.10 FDD 5 MHz: R.11 TDD 10 MHz: R.6 TDD 20 MHz: R.10 TDD
OCNG Patterns Note2		5 MHz: OP.20 FDD 10 MHz: OP.10 FDD 20 MHz: OP.17 FDD 5 MHz: OP.9 TDD 10 MHz: OP.1 TDD 20 MHz: OP.7 TDD
PBCH_RA	dB	0
PBCH_RB	dB	
PSS_RA	dB	
SSS_RA	dB	
PCFICH_RB	dB	
PHICH_RA	dB	
PHICH_RB	dB	
PDCCH_RA	dB	
PDCCH_RB	dB	
PDSCH_RA	dB	
PDSCH_RB	dB	
OCNG_RA Note3	dB	
OCNG_RB Note3	dB	
N_{oc} Note4	dBm/15 kHz	-104
$\hat{E}_s/N_{oc}$	dB	-3
$\hat{E}_s/I_{ot}$	dB	-3
RSRP Note5	dBm/15 kHz	-107
SCH_RP Note5	dBm/15 kHz	-107
Io Note5	dBm/Ch BW	-74.45 +10log ($N_{RB,c}$ /50)
Propagation Condition		AWGN
Antenna Configuration		1x2

Note 1: Special subframe and uplink-downlink configurations are specified in table 4.2-1 in TS 36.211 [23].
Note 2: DL RMCs and OCNG patterns are specified in clauses A 3.1 and A 3.2 of TS 36.133 [15] respectively.
Note 3: OCNG shall be used such that all cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 4: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 5: Es/Iot, RSRP, SCH_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.

Table A.8.5.1.1.2-3: Test parameters for SFTD accuracy (Cell 2)

Parameter		Config	Unit	Test 1
SSB GSCN		1~6		freq1
Duplex mode		1,4		FDD
		2,5		TDD
		3,6		TDD
TDD Configuration		1,4		N/A
		2,5		TDDConf.1.1
		3,6		TDDConf.2.1
$BW_{channel}$		1,4	MHz	10: $N_{RB,c}$ = 52
		2,5		10: $N_{RB,c}$ = 52
		3,6		40: $N_{RB,c}$ = 106
PDSCH Reference measurement channel		1,4		SR.1.1 FDD
		2,5		SR.1.1 TDD
		3,6		SR.2.1 TDD
RMSI CORESET Reference Channel		1,4		CR.1.1 FDD
		2,5		CR.1.1 TDD
		3,6		CR.2.1 TDD
RMC CORESET Reference Channel		1,4		CCR.1.1 FDD
		2,5		CCR.1.1 TDD
		3,6		CCR.2.1 TDD
SSB configuration		1,4		SSB.1 FR1
		2,5		SSB.1 FR1
		3,6		SSB.2 FR1
SMTC configuration		1~6		SMTC.1
DL BWP configuration		1~6		DLBWP.1.1
UL BWP configuration		1~6		ULBWP.1.1
OCNG Patterns		1~6		OP.1
EPRE ratio of PSS to SSS		1~6	dB	0
EPRE ratio of PBCH DMRS to SSS				
EPRE ratio of PBCH to PBCH DMRS				
EPRE ratio of PDCCH DMRS to SSS				
EPRE ratio of PDCCH to PDCCH DMRS				
EPRE ratio of PDSCH DMRS to SSS				
EPRE ratio of PDSCH to PDSCH DMRS				
EPRE ratio of OCNG DMRS to SSS Note 1				
EPRE ratio of OCNG to OCNG DMRS Note 1				
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1~6	dBm/15kHz	-104
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
N_{oc} Note2	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SSB SCS	-104
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			

	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-101
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
$\hat{E}_s/I_{ot}$		1~6	dB	-3
$\hat{E}_s/N_{oc}$		1~6	dB	-3
SS-RSRP Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/SCS	-107
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6		-104
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
Io Note3	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	1,2,4,5	dBm/9.36 MHz	-74.28
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			
	NR_FDD_FR1_H			
	NR_FDD_FR1_A, NR_TDD_FR1_A NOTE 5	3,6	dBm/38.16 MHz	-68.18
	NR_FDD_FR1_B			
	NR_TDD_FR1_C			
	NR_FDD_FR1_D, NR_TDD_FR1_D			
	NR_FDD_FR1_E, NR_TDD_FR1_E			
	NR_FDD_FR1_F			
	NR_FDD_FR1_G			

	NR_FDD_FR1_H			
Propagation condition		1~6		AWGN
Antenna configuration		1~6		1x2
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification				

Table A.8.5.1.1.2-4: Timing offsets for SFTD accuracy test

Configuration	SFN offset between PCell and PSCell	Frame boundary offset between PCell and PSCell (Ts)
1	100	-122000
2	300	-60540
3	500	1000
4	700	62540
5	900	124000

A.8.5.1.1.3 Test Requirements

The SFTD reported by the UE consists of 2 elements, SFN offset and frame boundary offset between PCell and inter-RAT NR target cell. The reported SFTD accuracy shall fulfil the requirement in clause 9.1.27 in TS 36.133 [15].

A.8.5.2 E-UTRA – NR Inter-RAT Measurement Performance requirements

A.8.5.2.1 SS-RSRP

A.8.5.2.1.1 E-UTRAN – NR inter-RAT measurements with FR1 target cell

A.8.5.2.1.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.1 in TS 36.133 [15] for inter-RAT FR1 SS-RSRP measurements.

A.8.5.2.1.1.2 Test Parameters

Supported test configurations are shown in Table A.8.5.2.1.1.2-1. In this test case there are two cells on different carriers. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1. Cell 2 is the inter-RAT NR FR1 target cell. The absolute accuracy requirements of SS-RSRP inter-RAT measurement is tested by using test parameters in Table A.8.5.2.1.1.2-2.

Table A.8.5.2.1.1.2-1: SS-RSRP Inter-RAT SS-RSRP supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30 kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.8.5.2.1.1.2-2: SS-RSRP inter-RAT test parameters

Parameter	Unit	Test 1	Test 2
		Cell 2	Cell 2

SSB ARFCN				freq1		freq1	
Duplex mode		Config 1,4		FDD			
		Config 2,3,5,6		TDD			
TDD configuration		Config 1,4		Not Applicable			
		Config 2,5		TDDConf.1.1			
		Config 3,6		TDDConf.2.1			
Downlink initial BWP configuration				DLBWP.0.1			
Downlink dedicated BWP configuration				DLBWP.1.1			
Uplink initial BWP configuration				ULBWP.0.1			
Uplink dedicated BWP configuration				ULBWP.1.1			
DRX Cycle configuration			ms	Not Applicable			
TRS configuration		Config 1,4		TRS.1.1 FDD			
		Config 2,5		TRS.1.1 TDD			
		Config 3,6		TRS.1.2 TDD			
PDSCH Reference measurement channel		Config 1,4		-		-	
		Config 2,5					
		Config 3,6					
RMSI CORESET Reference Channel		Config 1,4		-		-	
		Config 2,5					
		Config 3,6					
Dedicated CORESET Reference Channel		Config 1,4		-		-	
		Config 2,5					
		Config 3,6					
OCNG Patterns				OP.1			
SS-RSSI-Measurement				Not Applicable			
SMTC configruation				SMTC.1			
SSB configuration		Config 1,2,4,5		SSB.1 FR1			
		Config 3,6		SSB.2 FR1			
PDSCH/PDCCH subcarrier spacing		Config 1,2,4,5	kHz	15			
		Config 3,6		30			
EPRE ratio of PSS to SSS			dB	0	0	0	0
EPRE ratio of PBCH DMRS to SSS							
EPRE ratio of PBCH to PBCH DMRS							
EPRE ratio of PDCCH DMRS to SSS							
EPRE ratio of PDCCH to PDCCH DMRS							
EPRE ratio of PDSCH DMRS to SSS							
EPRE ratio of PDSCH to PDSCH							
EPRE ratio of OCNG DMRS to SSS(Note 1)							
EPRE ratio of OCNG to OCNG DMRS (Note 1)							
N_{oc} Note2	Config 1,2,3,4,5,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-94.65		-117	
		NR_FDD_FR1_B				-116.5	
		NR_TDD_FR1_C				-116	
		NR_FDD_FR1_D NR_TDD_FR1_D				-115.5	
		NR_FDD_FR1_E NR_TDD_FR1_E				-115	
		NR_FDD_FR1_F				-114.5	
		NR_FDD_FR1_G				-114	
		NR_FDD_FR1_H				-113.5	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-94.65		Same as Noc for 15kHz	

	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-91.65	-114
		NR_FDD_FR1_B			-113.5
		NR_TDD_FR1_C			-113
		NR_FDD_FR1_D NR_TDD_FR1_D			-112.5
		NR_FDD_FR1_E NR_TDD_FR1_E			-112
		NR_FDD_FR1_F			-111.5
		NR_FDD_FR1_G			-111
		NR_FDD_FR1_H			-110.5
$\hat{E}_s/I_{ot}$			dB	10	-4
$\hat{E}_s/N_{oc}$			dB	10	-4
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-84.65	-121
		NR_FDD_FR1_B			-120.5
		NR_TDD_FR1_C			-120
		NR_FDD_FR1_D NR_TDD_FR1_D			-119.5
		NR_FDD_FR1_E NR_TDD_FR1_E			-119
		NR_FDD_FR1_F			-118.5
		NR_FDD_FR1_G			-118
		NR_FDD_FR1_H			-117.5
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-81.65	-118
		NR_FDD_FR1_B			-117.5
		NR_TDD_FR1_C			-117
		NR_FDD_FR1_D NR_TDD_FR1_D			-116.5
		NR_FDD_FR1_E NR_TDD_FR1_E			-116
		NR_FDD_FR1_F			-115.5
		NR_FDD_FR1_G			-115
		NR_FDD_FR1_H			-114.5
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36MHz	-56.28	-87.76
		NR_FDD_FR1_B			-87.26
		NR_TDD_FR1_C			-86.76
		NR_FDD_FR1_D NR_TDD_FR1_D			-86.26
		NR_FDD_FR1_E NR_TDD_FR1_E			-85.76
		NR_FDD_FR1_F			-85.26
		NR_FDD_FR1_G			-84.76
		NR_FDD_FR1_H			-84.26
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16MHz	-50.19	-84.76
		NR_FDD_FR1_B			-84.26
		NR_TDD_FR1_C			-83.76
		NR_FDD_FR1_D NR_TDD_FR1_D			-83.26
		NR_FDD_FR1_E NR_TDD_FR1_E			-82.76

		NR_FDD_FR1_F			-82.26
		NR_FDD_FR1_G			-81.76
		NR_FDD_FR1_H			-81.26
Propagation condition			-	AWGN	
Antenna configuration			-	1x2	
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled. Note 3: SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port. Note 5: NR operating band groups are as defined in clause 3.5.2. Note 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.					

A.8.5.2.1.1.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.1 in TS 36.133 [15].

A.8.5.2.1.2 E-UTRAN – NR inter-RAT measurements with FR2 target cell

A.8.5.2.1.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRP measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.1 in TS 36.133 [15] for inter-RAT FR2 SS-RSRP measurements.

A.8.5.2.1.2.2 Test Parameters

Supported test configurations are shown in Table A.8.5.2.1.2.2-1. In this test case there are two cells on different carriers. Absolute accuracy requirements of SS-RSRP inter-RAT measurement are tested by using test setup in Table A.8.5.2.1.2.2-2 and Table A.8.5.2.1.2.2-3. In all test cases, Cell 2 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1.

Table A.8.5.2.1.2.2-1: SS-RSRP Inter-RAT SS-RSRP supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.8.5.2.1.2.2-2: SS-RSRP Inter-RAT general test parameters

Parameter	Unit	Test 1	Test 2
		Cell 2	Cell 2
SSB ARFCN		Freq1	freq1
Duplex mode		TDD	TDD
TDD configuration		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
Downlink initial BWP configuration		DLBWP.0.1	
Downlink dedicated BWP configuration		DLBWP.1.1	
Uplink initial BWP configuration		ULBWP.0.1	
Uplink dedicated BWP configuration		ULBWP.1.1	
DRX cycle configuration	ms	Not applicable	
TRS configuration		TRS.2.1 TDD	
TCI state		TCI.State.0	
PDSCH Reference measurement channel		-	-
RMSI CORESET Reference Channel		-	-
OCNG Patterns		OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1
SSB configuration		SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS[Note 1]			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Void Note 3: Void Note 4: Void			

Table A.8.5.2.1.2.2-3: SS-RSRP Inter-RAT OTA related test parameters

Parameter	Unit	Test 1	Test 2
		Cell 2	**Cell 2**
Angle of arrival configuration		Setup 1 according to A.3.15.1	Setup 1 according to A.3.15.1
Assumption for UE beams Note 10		Rough	Rough
N_{oc} Note1	dBm/15kHz Note4	-105	N/A
N_{oc} Note1	dBm/SCS Note4	-96	N/A
Es	dBm/SCS Note4		(Table B.2.3-2 Rx Beam Peak +1dB) (Note 7)
$\hat{E}_s/N_{oc}$	dB	11	N/A
SSB_RP Note2	dBm/SCS Note4	-85	(Table B.2.3-2 Rx Beam Peak +1dB) (Note 7)
$\hat{E}_s/I_{ot\ BB}$ Note 2, Note 9	dB	9.97	-3.81
Io Note2	dBm/95.04 MHz Note4	-55.65	(Table B.2.3-2 Rx Beam Peak +30dB) (Note 8)

Note 1: Where used, interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SSB_RP, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: Void
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.
Note 5: Void
Note 6: Void
Note 7: SSB_RP is applied at 1dB above the minimum level specified in Table B.2.3-2 for beam peak.
Note 8: Io is applied at $10\log_{10}(792)$dB+1dB above the minimum level specified in Table B.2.3-2 for beam peak.
Note 9: Calculation of Es/Iot_{BB} includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 36.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMB_P from TS 38.101-2 [19] Table 6.2.1.3-4.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.8.5.2.1.2.3 Test Requirements

The SS-RSRP measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.1 in TS 36.133 [15].

A.8.5.2.2 SS-RSRQ

A.8.5.2.2.1 E-UTRAN – NR inter-RAT measurements with FR1 target cell

A.8.5.2.2.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.2 in TS 36.133 [15] for inter-RAT FR1 SS-RSRQ measurements.

A.8.5.2.2.1.2 Test Parameters

Supported test configurations are shown in Table A.8.5.2.2.1.2-1. In this test case there are two cells on different carriers. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1. Cell 2 is the inter-RAT NR FR1 target cell. The absolute accuracy requirements of SS-RSRP inter-RAT measurement is tested by using test parameters in Table A.8.5.2.2.1.2-2.

Table A.8.5.2.2.1.2-1: SS-RSRQ Inter-RAT SS-RSRQ supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.8.5.2.2.1.2-2: SS-RSRQ inter-RAT test parameters

Parameter	Unit	Test 1	Test 2	Test 3
		Cell 2	Cell 2	Cell 2

SSB ARFCN				freq1		freq1		freq1	
Duplex mode	Config 1,4			FDD					
	Config 2,3,5,6			TDD					
TDD configuration	Config 1,4			Not Applicable					
	Config 2,5			TDDConf.1.1					
	Config 3,6			TDDConf.2.1					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
DRX Cycle configuration			ms	Not Applicable					
TRS configuration	Config 1,4			TRS.1.1 FDD					
	Config 2,5			TRS.1.1 TDD					
	Config 3,6			TRS.1.2 TDD					
PDSCH Reference measurement channel	Config 1,4			-		-		-	
	Config 2,5								
	Config 3,6								
RMSI CORESET Reference Channel	Config 1,4			-		-		-	
	Config 2,5								
	Config 3,6								
Dedicated CORESET Reference Channel	Config 1,4			-		-		-	
	Config 2,5								
	Config 3,6								
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
SMTC configruation				SMTC.1					
SSB configuration	Config 1,2,4,5			SSB.1 FR1					
	Config 3,6			SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing	Config 1,2,4,5		kHz	15					
	Config 3,6			30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-80.18		-106		-116	
		NR_FDD_FR1_B						-115.5	
		NR_TDD_FR1_C						-115	
		NR_FDD_FR1_D NR_TDD_FR1_D						-114.5	
		NR_FDD_FR1_E NR_TDD_FR1_E						-114	
		NR_FDD_FR1_F						-113.5	
		NR_FDD_FR1_G						-113	
		NR_FDD_FR1_H						-112.5	
	Config 3,6			-86.27		-113		Same as Noc for Config 1,2,4,5	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	-80.18		-106		Same as Noc for 15kHz	

	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-83.27	-110	-113
		NR_FDD_FR1_B				-112.5
		NR_TDD_FR1_C				-112
		NR_FDD_FR1_D NR_TDD_FR1_D				-111.5
		NR_FDD_FR1_E NR_TDD_FR1_E				-111
		NR_FDD_FR1_F				-110.5
		NR_FDD_FR1_G				-110
		NR_FDD_FR1_H				-109.5
$\hat{E}_s/I_{ot}$			dB	-1.75	-1.75	-1.75
$\hat{E}_s/N_{oc}$			dB	-1.75	-1.75	-1.75
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-81.93	-107.75	-117.75
		NR_FDD_FR1_B				-117.25
		NR_TDD_FR1_C				-116.75
		NR_FDD_FR1_D NR_TDD_FR1_D				-116.25
		NR_FDD_FR1_E NR_TDD_FR1_E				-115.75
		NR_FDD_FR1_F				-115.25
		NR_FDD_FR1_G				-114.75
		NR_FDD_FR1_H				-114.25
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85.02	-111.75	-114.75
		NR_FDD_FR1_B				-114.25
		NR_TDD_FR1_C				-113.75
		NR_FDD_FR1_D NR_TDD_FR1_D				-113.25
		NR_FDD_FR1_E NR_TDD_FR1_E				-112.75
		NR_FDD_FR1_F				-112.25
		NR_FDD_FR1_G				-111.75
		NR_FDD_FR1_H				-111.25
SS-RSRQ Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-14.77	-40.59	-14.76
		NR_FDD_FR1_B				
		NR_TDD_FR1_C				
		NR_FDD_FR1_D NR_TDD_FR1_D				
		NR_FDD_FR1_E NR_TDD_FR1_E				
		NR_FDD_FR1_F				
		NR_FDD_FR1_G				
		NR_FDD_FR1_H				
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36MHz	-50	-75.83	-85.83
		NR_FDD_FR1_B				-85.33
		NR_TDD_FR1_C				-84.83
		NR_FDD_FR1_D NR_TDD_FR1_D				-84.33
		NR_FDD_FR1_E NR_TDD_FR1_E				-83.83

		NR_FDD_FR1_F				-83.33
		NR_FDD_FR1_G				-82.83
		NR_FDD_FR1_H				-82.33
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16MHz	-50	-76.73	-79.73
		NR_FDD_FR1_B				-79.23
		NR_TDD_FR1_C				-78.73
		NR_FDD_FR1_D NR_TDD_FR1_D				-78.23
		NR_FDD_FR1_E NR_TDD_FR1_E				-77.73
		NR_FDD_FR1_F				-77.23
		NR_FDD_FR1_G				-76.73
		NR_FDD_FR1_H				-76.53
Propagation condition			-	AWGN		
Antenna configuration			-	1x2		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-RSRQ, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-RSRQ minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in clause 3.5.2.
Note 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.8.5.2.2.1.3 Test Requirements

The SS-RSRQ measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.2 in TS 36.133 [15].

A.8.5.2.2.2 E-UTRAN – NR inter-RAT measurements with FR2 target cell

A.8.5.2.2.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS-RSRQ measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.2 in TS 36.133 [15] for inter-RAT FR2 SS-RSRQ measurements.

A.8.5.2.2.2.2 Test Parameters

Supported test configurations are shown in Table A.8.5.2.2.2.2-1. In this test case there are two cells on different carriers. Absolute accuracy requirements of SS-RSRQ inter-RAT measurement are tested by using test setup in Table A.8.5.2.2.2.2-2 and Table A.8.5.2.2.2.2-3. In all test cases, Cell 2 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1.

Table A.8.5.2.2.2.2-1: SS-RSRQ Inter-RAT SS-RSRQ supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.8.5.2.2.2.2-2: SS-RSRQ Inter-RAT general test parameters

Parameter	Unit	Test 1	Test 2
		Cell 2	Cell 2
SSB ARFCN		Freq1	freq1
Duplex mode		TDD	TDD
TDD configuration		TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
Downlink initial BWP configuration		DLBWP.0.1	
Downlink dedicated BWP configuration		DLBWP.1.1	
Uplink initial BWP configuration		ULBWP.0.1	
Uplink dedicated BWP configuration		ULBWP.1.1	
DRX cycle configuration	ms	Not applicable	
TRS configuration		TRS.2.1 TDD	
TCI state		TCI.State.0	
PDSCH Reference measurement channel		-	-
RMSI CORESET Reference Channel		-	-
OCNG Patterns		OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1
SSB configuration		SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120
EPRE ratio of PSS to SSS	dB	0	0
EPRE ratio of PBCH_DMRS to SSS			
EPRE ratio of PBCH to PBCH_DMRS			
EPRE ratio of PDCCH_DMRS to SSS			
EPRE ratio of PDCCH to PDCCH_DMRS			
EPRE ratio of PDSCH_DMRS to SSS			
EPRE ratio of PDSCH to PDSCH_DMRS			
EPRE ratio of OCNG DMRS to SSS[Note 1]			
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Void Note 3: Void Note 4: Void			

Table A.8.5.2.2.2.2-3: SS-RSRQ Inter-RAT OTA related test parameters

Parameter	Unit	Test 1	Test 2
		Cell 2	Cell 2
Angle of arrival configuration		Setup 1 according to A.3.15.1	Setup 1 according to A.3.15.1
Assumption for UE beams Note 10		Rough	Rough
N_{oc} Note1	dBm/15kHz Note4	-105	(Table B.2.3-2 Rx Beam Peak -5dB) (Note 7)
N_{oc} Note1	dBm/SCS Note4	-96	(Table B.2.3-2 Rx Beam Peak +4dB) (Note 7)
$\hat{E}_s / N_{oc}$	dB	-0.5	-1.75
SSB_RP Note2	dBm/SCS Note4	-96.5	(Table B.2.3-2 Rx Beam Peak +2.25dB) (Note 8)
SS-RSRQ Note2	dB	-14.4	-14.82
$\hat{E}_s / I_{ot}$ Note2	dB	-0.5	-1.75
Io Note2	dBm/95.04 MHz Note4	-63.9	(Table B.2.3-2 Rx Beam Peak +35.22dB) (Note 9)

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SSB_RP, SS-RSRQ, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: Void
Note 4: Equivalent power received by an antenna with 0dBi gain at the centre of the quiet zone.
Note 5: Void
Note 6: Void
Note 7: N_{oc} for SCS 15kHz is applied at $-10\log_{10}(8)$+4dB above the minimum level specified in Table B.2.3-2 for beam peak. N_{oc} for SCS 120kHz is applied at 4dB above the minimum level specified in Table B.2.3-2 for beam peak.
Note 8: SSB_RP is applied at 2.25dB above the minimum level specified in Table B.2.3-2 for beam peak.
Note 9: Io is applied at $10\log_{10}(792)$+6.22dB above the minimum level specified in Table B.2.3-2 for beam peak.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.8.5.2.2.2.3 Test Requirements

The SS-RSRQ measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.2 in TS 36.133 [15].

In this test case there are two cells on different carriers and measurement gaps are provided

A.8.5.2.3 SS-SINR

A.8.5.2.3.1 E-UTRAN – NR inter-RAT measurements with FR1 target cell

A.8.5.2.3.1.1 Test Purpose and Environment

The purpose of this test is to verify that the SS- SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.3 in TS 36.133 [15] for inter-RAT FR1 SS-SINR measurements.

A.8.5.2.3.1.2 Test Parameters

Supported test configurations are shown in Table A.8.5.2.3.1.2-1. In this test case there are two cells on different carriers. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1. Cell 2 is the inter-RAT NR FR1 target cell. The absolute accuracy requirements of SS-RSRP inter-RAT measurement is tested by using test parameters in Table A.8.5.2.3.1.2-2.

Table A.8.5.2.3.1.2-1: SS- SINR Inter-RAT SS- SINR supported test configurations

Config	Description
1	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
2	LTE FDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
3	LTE FDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
4	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode
5	LTE TDD, NR 15 kHz SSB SCS, 10 MHz bandwidth, TDD duplex mode
6	LTE TDD, NR 30kHz SSB SCS, 40 MHz bandwidth, TDD duplex mode
Note: The UE is only required to be tested in one of the supported test configurations	

Table A.8.5.2.3.1.2-2: SS-SINR inter-RAT test parameters

Parameter	Unit	Test 1	Test 2	Test 3
		Cell 2	Cell 2	Cell 2

SSB ARFCN				freq1		freq1		freq1	
Duplex mode		Config 1,4		FDD					
		Config 2,3,5,6		TDD					
TDD configuration		Config 1,4		Not Applicable					
		Config 2,5		TDDConf.1.1					
		Config 3,6		TDDConf.2.1					
Downlink initial BWP configuration				DLBWP.0.1					
Downlink dedicated BWP configuration				DLBWP.1.1					
Uplink initial BWP configuration				ULBWP.0.1					
Uplink dedicated BWP configuration				ULBWP.1.1					
DRX Cycle configuration			ms	Not Applicable					
TRS configuration		Config 1,4		TRS.1.1 FDD					
		Config 2,5		TRS.1.1 TDD					
		Config 3,6		TRS.1.2 TDD					
PDSCH Reference measurement channel		Config 1,4		-		-		-	
		Config 2,5							
		Config 3,6							
RMSI CORESET Reference Channel		Config 1,4		-		-		-	
		Config 2,5							
		Config 3,6							
Dedicated CORESET Reference Channel		Config 1,4		-		-		-	
		Config 2,5							
		Config 3,6							
OCNG Patterns				OP.1					
SS-RSSI-Measurement				Not Applicable					
SMTC configruation				SMTC.1					
SSB configuration		Config 1,2,4,5		SSB.1 FR1					
		Config 3,6		SSB.2 FR1					
PDSCH/PDCCH subcarrier spacing		Config 1,2,4,5	kHz	15					
		Config 3,6		30					
EPRE ratio of PSS to SSS			dB	0	0	0	0	0	0
EPRE ratio of PBCH DMRS to SSS									
EPRE ratio of PBCH to PBCH DMRS									
EPRE ratio of PDCCH DMRS to SSS									
EPRE ratio of PDCCH to PDCCH DMRS									
EPRE ratio of PDSCH DMRS to SSS									
EPRE ratio of PDSCH to PDSCH									
EPRE ratio of OCNG DMRS to SSS(Note 1)									
EPRE ratio of OCNG to OCNG DMRS (Note 1)									
N_{oc} Note2	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/15kHz	-880		-108.5		-119.5	
		NR_FDD_FR1_B						-119	
		NR_TDD_FR1_C						-118.5	
		NR_FDD_FR1_D NR_TDD_FR1_D						-118	
		NR_FDD_FR1_E NR_TDD_FR1_E						-117.5	
		NR_FDD_FR1_F						-117	
		NR_FDD_FR1_G						-116.5	
		NR_FDD_FR1_H						-116	
N_{oc} Note2	Config 1,2,4,5		dBm/SCS	[-80]		-88		-108.5	

	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-85	-105.5	-116.5
		NR_FDD_FR1_B				-116
		NR_TDD_FR1_C				-115.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-115
		NR_FDD_FR1_E NR_TDD_FR1_E				-114.5
		NR_FDD_FR1_F				-114
		NR_FDD_FR1_G				-114.5
		NR_FDD_FR1_H				-113]
$\hat{E}_s/I_{ot}$			dB	-1.75	20	-4.0
$\hat{E}_s/N_{oc}$			dB	-1.75	20	-4.0
SS-RSRP Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/SCS	-89.75	-88.5	-123.5
		NR_FDD_FR1_B				-123
		NR_TDD_FR1_C				-122.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-122
		NR_FDD_FR1_E NR_TDD_FR1_E				-121.5
		NR_FDD_FR1_F				-121
		NR_FDD_FR1_G				-120.5
		NR_FDD_FR1_H				-120
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6		-86.75	-85.5	-120.5
		NR_FDD_FR1_B				-120
		NR_TDD_FR1_C				-119.5
		NR_FDD_FR1_D NR_TDD_FR1_D				-119
		NR_FDD_FR1_E NR_TDD_FR1_E				-118.5
		NR_FDD_FR1_F				-118
		NR_FDD_FR1_G				-117.5
		NR_FDD_FR1_H				-117
SS-SINR Note3		NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dB	-1.75	20	-4.0
		NR_FDD_FR1_B				
		NR_TDD_FR1_C				
		NR_FDD_FR1_D NR_TDD_FR1_D				
		NR_FDD_FR1_E NR_TDD_FR1_E				
		NR_FDD_FR1_F				
		NR_FDD_FR1_G				
		NR_FDD_FR1_H				
Io Note3	Config 1,2,4,5	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 9.36MHz	-57.83	-60.5	-90.09
		NR_FDD_FR1_B				-89.59
		NR_TDD_FR1_C				-89.09
		NR_FDD_FR1_D NR_TDD_FR1_D				-88.59
		NR_FDD_FR1_E NR_TDD_FR1_E				-88.09

		NR_FDD_FR1_F				-87.59
		NR_FDD_FR1_G				-87.09
		NR_FDD_FR1_H				-86.59
	Config 3,6	NR_FDD_FR1_A NR_TDD_FR1_A NOTE 6	dBm/ 38.16MHz	-51.73	-54.41	-84
		NR_FDD_FR1_B				-83.5
		NR_TDD_FR1_C				-83
		NR_FDD_FR1_D NR_TDD_FR1_D				-82.5
		NR_FDD_FR1_E NR_TDD_FR1_E				-82
		NR_FDD_FR1_F				-81.5
		NR_FDD_FR1_G				-81
		NR_FDD_FR1_H				-80.5
Propagation condition			-	AWGN		
Antenna configuration			-	1x2		

Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols.
Note 2: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 3: SS-SINR, SS-RSRP, and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 4: SS-SINR, SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.
Note 5: NR operating band groups are as defined in clause 3.5.2.
Note 6: The test configuration excludes support for band n51 and it is not required to run this test on band n51 in this release of the specification.

A.8.5.2.3.1.3 Test Requirements

The SS-SINR measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.3 in TS 36.133 [15].

A.8.5.2.3.2 E-UTRAN – NR inter-RAT measurements with FR2 target cell

A.8.5.2.3.2.1 Test Purpose and Environment

The purpose of this test is to verify that the SS- SINR measurement accuracy is within the specified limits. This test will verify the requirements in clause 9.11.3 in TS 36.133 [15] for inter-RAT FR2 SS-SINR measurements.

A.8.5.2.3.2.2 Test Parameters

Supported test configurations are shown in Table A.8.5.2.3.2.2-1. In this test case there are two cells on different carriers. Absolute accuracy requirements of SS-SINR inter-RAT measurement are tested by using test setup in Table A.8.5.2.3.2.2-2 and A.8.5.2.3.2.2-3. In all test cases, Cell 2 is target cell. Cell 1 is the E-UTRA cell which specific test parameters for this test case are specified in Table A.3.7.2.1-1.

Table A.8.5.2.3.2.2-1: SS-SINR Inter-RAT SS-SINR supported test configurations

Configuration	Description
1	LTE FDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode
2	LTE TDD, NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode

Table A.8.5.2.3.2.2-2: SS-SINR Inter-RAT general test parameters

Parameter	Unit	Test 1	Test 2	Test 3
		Cell 2	**Cell 2**	**Cell 2**
SSB ARFCN		Freq1	freq1	freq1
Duplex mode		TDD	TDD	TDD
TDD configuration		TDDConf.3.1	TDDConf.3.1	TDDConf.3.1
$BW_{channel}$	MHz	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66	100: $N_{RB,c}$ = 66
Downlink initial BWP configuration		DLBWP.0.1		
Downlink dedicated BWP configuration		DLBWP.1.1		
Uplink initial BWP configuration		ULBWP.0.1		
Uplink dedicated BWP configuration		ULBWP.1.1		
DRX cycle configuration	ms	Not applicable		
TRS configuration		TRS.2.1 TDD		
TCI state		TCI.State.0		
PDSCH Reference measurement channel		-	-	-
RMSI CORESET Reference Channel		-	-	-
OCNG Patterns		OP.1	OP.1	OP.1
SMTC configuration		SMTC.1	SMTC.1	SMTC.1
SSB configuration		SSB.3 FR2	SSB.3 FR2	SSB.3 FR2
PDSCH/PDCCH subcarrier spacing	kHz	120	120	120
EPRE ratio of PSS to SSS	dB	0	0	0
EPRE ratio of PBCH_DMRS to SSS				
EPRE ratio of PBCH to PBCH_DMRS				
EPRE ratio of PDCCH_DMRS to SSS				
EPRE ratio of PDCCH to PDCCH_DMRS				
EPRE ratio of PDSCH_DMRS to SSS				
EPRE ratio of PDSCH to PDSCH_DMRS				
EPRE ratio of OCNG DMRS to SSS[Note 1]				
Note 1: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. Note 2: Void Note 3: Void Note 4: Void				

Table A.8.5.2.3.2.2-3: SS-SINR Inter-RAT OTA related test parameters

Parameter	Unit	Test 1	Test 2	Test 3
		Cell 2	Cell 2	Cell 2
Angle of arrival configuration		Setup 1 according to A.3.15.1	Setup 1 according to A.3.15.1	Setup 1 according to A.3.15.1
Assumption for UE beams Note 10		Rough	Rough	Rough
N_{oc} Note1	dBm/15kHz Note4	-105	-105	(Table B.2.3-2 Rx Beam Peak -5dB) (Note 7)
N_{oc} Note1	dBm/SCS Note4	-96	-96	(Table B.2.3-2 Rx Beam Peak +4dB) (Note 7)
$\hat{E}_s/N_{oc}$	dB	-0.5	11	-1.0
SSB_RP Note2	dBm/SCS Note4	-96.5	-85	(Table B.2.3-2 Rx Beam Peak +3dB) (Note 8)
SS-SINR Note2	dB	-0.5	11	-1.0
$\hat{E}_s/I_{ot}$ Note2	dB	-0.5	11	-1.0
Io Note2	dBm/95.04 MHz Note4	-69.3	-55.4	(Table B.2.3-2 Rx Beam Peak +35.54dB) (Note 9)

Note 1: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for N_{oc} to be fulfilled.
Note 2: SSB_RP, SS-SINR, Es/Iot and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.
Note 3: Void
Note 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zone.
Note 5: Void
Note 6: Void
Note 7: N_{oc} for SCS 15kHz is applied at $-10\log_{10}(8)$+4dB above the minimum level specified in Table B.2.3-2 for beam peak. N_{oc} for SCS 120kHz is applied at 4dB above the minimum level specified in Table B.2.3-2 for beam peak.
Note 8: SSB_RP is applied at 3dB above the minimum level specified in Table B.2.3-2 for beam peak.
Note 9: Io is applied at level $10\log_{10}(792)$+6.54dB above the minimum level specified in Table B.2.3-2 for beam peak.
Note 10: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementation.

A.8.5.2.3.2.3 Test Requirements

The SS-SINR measurement accuracy for Cell 2 shall fulfil the requirement in clause 9.11.3 in TS 36.133 [15].

Annex B (normative): Conditions for RRM requirements applicability for operating bands

B.1 Conditions for NR RRC_IDLE state mobility

B.1.1 Introduction

In Annex B.1, the following conditions are specified:

- UE conditions which shall apply for UE intra-frequency measurements procedures and requirements in clause 4,
- UE conditions which shall apply for UE inter-frequency measurements procedures and requirements in clause 4.

B.1.2 Conditions for measurements on NR intra-frequency cells for cell re-selection

This clause defines the following conditions for NR intra-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.1.2-1 for FR1 NR cells.

The conditions are defined in Table B.1.2-2 for FR2 NR cells.

Table B.1.2-1: Conditions for intra-frequency cell re-selection in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP dBm / SCS_{SSB}		SSB Ês/Iot
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	dB
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A	-124	-121	≥ -4
	NR_FDD_FR1_B	-123.5	-120.5	
	NR_TDD_FR1_C	-123	-120	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	
	NR_FDD_FR1_F	-121.5	-118.5	
	NR_FDD_FR1_G	-121	-118	
	NR_FDD_FR1_H	-120.5	-117.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.1.2-2: Conditions for intra-frequency cell re-selection in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3					SSB Ês/Iot
			dBm / SCS_{SSB}					dB
			SCS_{SSB} = 120 kHz				SCS_{SSB} = 240 kHz	
			UE Power class				UE Power class	
			1	2	3	4	1, 2, 3, 4	
Conditions	Rx Beam Peak	n257	$-125.3+Y_1$	-110.8	-109.1	$-124.8+Y_4$	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-4
		n258	$-125.3+Y_1$	-110.8	-109.1	$-124.8+Y_4$		
		n259			-105.5			
		n260	$-122.3+Y_1$		-106.5	$-122.8+Y_4$		
		n261	$-125.3+Y_1$	-110.8	-109.1	$-124.8+Y_4$		
	Spherical coverage Note 1	n257	$-117.3+Z_1$	-99.8	-98.2	$-115.8+Z_4$	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-4
		n258	$-117.3+Z_1$	-99.8	-98.2	$-115.8+Z_4$		
		n259			-92.7			
		n260	$-114.3+Z_1$		-93.9	$-110.8+Z_4$		
		n261	$-117.3+Z_1$	-99.8	-98.2	$-115.8+Z_4$		

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.1.2-2:

- The value of Y for Power classes 1 and 4 is FFS, where Y_1 and Y_4 are the rough/fine beam gain differences in Rx beam peak direction for Power classes 1 and 4 respectively

- The value of Z for Power classes 1 and 4 is FFS, where Z_1 and Z_4 are the rough/fine beam gain differences in spherical coverage directions for Power classes 1 and 4 respectively

B.1.3 Conditions for measurements on NR inter-frequency cells for cell re-selection

This clause defines the following conditions for NR inter-frequency measurements performed based on SSBs for cell re-selection: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions defined in Table B.1.2-1 for FR1 NR intra-frequency cell re-selection shall also apply for FR1 NR inter-frequency cells in this clause.

The conditions defined in Table B.1.2-2 for FR2 NR intra-frequency cell re-selection shall also apply for FR2 NR inter-frequency cells in this clause.

B.2 Conditions for UE measurements procedures and performance requirements in RRC_CONNECTED state

B.2.1 Introduction

B.2.1.1 General

In Annex B.2, the following conditions are specified:

- The conditions for RRC connection release with redirection to NR requirements in clause 6.2.3.2.1,
- The conditions for UE transmit timing adjustment in clause 7.1
- UE conditions which shall apply for UE intra-frequency measurements procedures and requirements in clause 9,

  UE conditions which shall apply for UE inter-frequency measurements procedures and requirements in clause 9,
- UE conditions which shall apply for UE intra-frequency measurements performance requirements in clause 10,
- UE conditions which shall apply for UE inter-frequency measurements performance requirements in clause 10.

B.2.1.2 Derivation of Minimum SSB_RP values for FR1

[FFS]

B.2.1.3 Derivation of Minimum SSB_RP values for FR2

Editor's note:

- The Assumption for UE beams (fine or rough) in Annex A RRM test cases is defined based on power class 3, and unless otherwise stated also applies for other UE power classes

B.2.1.3.1 Minimum SSB_RP values for Rx Beam Peak angle of arrival

Minimum SSB_RP values in Tables B.2.2-2 and B.2.3-2 are based on Reference sensitivity for the Operating band and for the UE power class, taking a baseline of UE Power class 3 in Band n260 with 50 MHz channel bandwidth.

Minimum SSB_RP = Reference sensitivity $_{\text{PC3, n260, 50MHz}}$ +Y -10Log$_{10}$(PRB$_{\text{Refsens}}$ x 12) – SNR$_{\text{Refsens}}$ + SSB Ês/Iot + ΔMB$_{\text{P,n}}$

where:

Reference sensitivity $_{\text{PC3, n260, 50MHz}}$ is the reference sensitivity value in dBm specified for power class 3 in Band n260 for 50 MHz Channel bandwidth in Table 7.3.2.3-1 of TS 38.101-2 [19];

Y is the gain difference between fine and rough beams, which is defined in Table B.2.1.3.1-1;

Table B.2.1.3.1-1: Gain difference Y between fine and rough beams, Rx beam peak direction

Value "Y" in dB, for each UE power class			
1	**2**	**3**	**4**
FFS	9.0	7.0	FFS

PRB$_{\text{Refsens}}$ is N$_{\text{RB}}$ associated with subcarrier spacing 120 kHz for 50MHz in TS 38.101-2 [19] Table 5.3.2-1, and is 32;

12 is the number of subcarriers in a PRB;

SNR$_{\text{Refsens}}$ is the SNR used for simulation of Refsens and EIS spherical coverage, and is -1 dB;

SSB Ês/Iot is the minimum value required by the UE to perform measurements, and is -6 dB for intra-frequency measurements and -4 dB for inter-frequency measurements. The only contribution to Iot is the UE internal noise;

$\Delta MB_{P,n}$ is the UE multi-band relaxation factor value in dB specified in TS 38.101-2 [19] clause 6.2.1.

The calculated Minimum SSB_RP value for the baseline of UE power class 3 in Band n260 is ($-109.5+\Delta MB_{P,n}$) dBm/120kHz for intra-frequency measurements and ($-107.5+\Delta MB_{P,n}$) dBm/120kHz for inter-frequency measurements.

The following methodology to define the Minimum SSB_RP level for power class X (PC_X) and operating band Y (Band_Y) is used:

For Intra-frequency: Minimum SSB_RP (PC_X, Band_Y) = -109.5 dBm/120kHz + $\text{Refsens}_{PC\_X,\ Band\_Y,\ 50MHz} - \text{Refsens}_{PC3,\ n260,\ 50MHz} + Y_{PC\_X} - Y_{PC3} + \Delta MB_{P,n}$,

For Inter-frequency: Minimum SSB_RP (PC_X, Band_Y) = -107.5 dBm/120kHz + $\text{Refsens}_{PC\_X,\ Band\_Y,\ 50MHz} - \text{Refsens}_{PC3,\ n260,\ 50MHz} + Y_{PC\_X} - Y_{PC3} + \Delta MB_{P,n}$.

B.2.1.3.2 Minimum SSB_RP values for angle of arrival within Spherical coverage

Minimum SSB_RP values in Tables B.2.2-2 and B.2.3-2 are based on EIS spherical coverage for the Operating band and for the UE power class, taking a baseline of UE power class 3 in Band n260 with 50 MHz channel bandwidth.

Minimum SSB_RP = EIS spherical coverage $_{PC3,\ n260,\ 50MHz}$ $+Z - 10\text{Log}_{10}(\text{PRB}_{Refsens} \times 12) - \text{SNR}_{Refsens}$ + SSB Ês/Iot + $\Delta MB_{S,n}$

where:

EIS spherical coverage $_{PC3,\ n260,\ 50MHz}$ is the EIS spherical coverage value in dBm specified for power class 3 in Band n260 for 50MHz Channel bandwidth in TS 38.101-2 [19] Table 7.3.4.3-1;

Z is the gain difference between fine and rough beams, and is defined in Table B.2.1.3.2-1;

Table B.2.1.3.2-1: Gain difference Z between fine and rough beams, Spherical coverage directions

Value "Z" in dB, for each UE power class			
1	**2**	**3**	**4**
FFS	9.0	7.0	FFS

$\text{PRB}_{Refsens}$ is N_{RB} associated with subcarrier spacing 120 kHz for 50MHz in TS 38.101-2 [19] Table 5.3.2-1, and is 32;

12 is the number of subcarriers in a PRB;

$\text{SNR}_{Refsens}$ is the SNR used for simulation of Refsens and EIS spherical coverage, and is -1 dB;

SSB Ês/Iot is the minimum value required by the UE to perform measurements, and is -6 dB for intra-frequency measurements and -4 dB for inter-frequency measurements. The only contribution to Iot is the UE internal noise;

$\Delta MB_{S,n}$ is the UE multi-band relaxation factor value in dB specified in TS 38.101-2 [19] clause 6.2.1.

The calculated Minimum SSB_RP value for the baseline of UE power class 3 in Band n260 is ($-96.9+\Delta MB_{S,n}$) dBm/120kHz for intra-frequency measurements and is ($-94.9+\Delta MB_{S,n}$) dBm/120kHz for inter-frequency measurements.

The following methodology to define the Minimum SSB_RP level for power class X (PC_X) and operating band Y (Band_Y) is used:

For Intra-frequency: Minimum SSB_RP (PC_X, Band_Y) = -96.9 dBm/120kHz + EIS spherical coverage $_{PC\_X,\ Band\_Y,\ 50MHz}$ – EIS spherical coverage $_{PC3,\ n260,\ 50MHz}$ $+ Z_{PC\_X} - Z_{PC3} + \Delta MB_{S,n}$

For Inter-frequency: Minimum SSB_RP (PC_X, Band_Y) = -94.9 dBm/120kHz + EIS spherical coverage $_{PC\_X,\ Band\_Y,\ 50MHz}$ – EIS spherical coverage $_{PC3,\ n260,\ 50MHz}$ $+ Z_{PC\_X} - Z_{PC3} + \Delta MB_{S,n}$

B.2.1.4 Gain to SS-RSRP measurement point for FR1

In FR1 conducted requirements are specified at the UE antenna connector, which is also the SS-RSRP measurement point.

B.2.1.5 Gain to SS-RSRP measurement point for FR2

B.2.1.5.1 Gain to SS-RSRP measurement point for Rx Beam Peak angle of arrival

In clause 5.1.1 of TS 38.215 [4] SS-RSRP is defined to be measured based on the combined signal from antenna elements corresponding to a given receiver branch. The reference point for requirement parameters from the UE perspective is the input of the UE antenna array. The gain “G” relates the combined signal from antenna elements corresponding to a given receiver branch to the reference point for requirement parameters.

The gain “G” affects absolute signal level values reported by the UE.

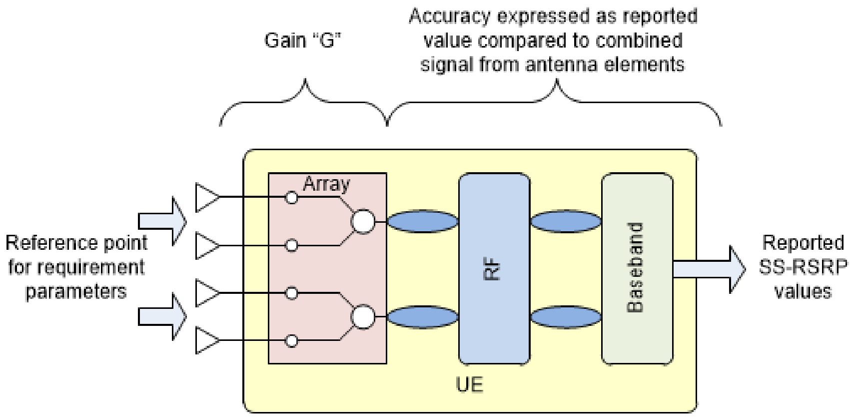


Figure B.2.1.5.1-1: Gain and Reference point for requirement parameters

The gain range for each power class is specified in Table B.2.1.5.1-1.

Table B.2.1.5.1-1: UE gain G, Rx beam peak direction

	UE Power class			
	1	2	3	4
Minimum, dBi	FFS	FFS	-10	FFS
Maximum, dBi	FFS	FFS	+20	FFS

Gain range in spherical coverage directions may be lower than in Rx beam peak direction, according to the difference between the EIS spherical coverage value specified in TS 38.101-2 [19] clause 7.3.4 and the Reference sensitivity level specified in TS 38.101-2 [19] clause 7.3.2.

B.2.2 Conditions for NR intra-frequency measurements

This clause defines the following conditions for NR intra-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.2.2-1 for FR1 NR cells.

The conditions are defined in Table B.2.2-2 for FR2 NR cells.

Table B.2.2-1: Conditions for intra-frequency measurements in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP dBm / SCS_{SSB}		SSB Ês/Iot
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	dB
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-127	-124	≥ -6
	NR_FDD_FR1_B	-126.5	-123.5	
	NR_TDD_FR1_C	-126	-123	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-125.5	-122.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-125	-122	
	NR_FDD_FR1_F	-124.5	-121.5	
	NR_FDD_FR1_G	-124	-121	
	NR_FDD_FR1_H	-123.5	-120.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.2-2: Conditions for intra-frequency measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3 dBm / SCS_{SSB}					SSB Ês/Iot
			SCS_{SSB} = 120 kHz				SCS_{SSB} = 240 kHz	dB
			UE power class				UE power class	
			1	2	3	4	1, 2, 3, 4	
Conditions	Rx Beam Peak	n257	-128.3+Y_1	-113.8	-112.1	-127.8+Y_4	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-6
		n258	-128.3+Y_1	-113.8	-112.1	-127.8+Y_4		
		n259			-108.5			
		n260	-125.3+Y_1		-109.5	-125.8+Y_4		
		n261	-128.3+Y_1	-113.8	-112.1	-127.8+Y_4		
	Spherical coverage Note 1	n257	-120.3+Z_1	-102.8	-101.2	-118.8+Z_4	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-6
		n258	-120.3+Z_1	-102.8	-101.2	-118.8+Z_4		
		n259			-95.7			
		n260	-117.3+Z_1		-96.9	-113.8+Z_4		
		n261	-120.3+Z_1	-102.8	-101.2	-118.8+Z_4		
Note 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met. Note 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise. Note 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].								

Editor's notes for Table B.2.2-2:

- The value of Y for power classes 1 and 4 is FFS, where Y_1 and Y_4 are the rough/fine beam gain differences in Rx beam peak direction for power classes 1 and 4 respectively

- The value of Z for power classes 1 and 4 is FFS, where Z_1 and Z_4 are the rough/fine beam gain differences in spherical coverage directions for power classes 1 and 4 respectively

B.2.3 Conditions for NR inter-frequency measurements

This clause defines the following conditions for NR inter-frequency measurements and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.2.3-1 for FR1 NR cells.

The conditions are defined in Table B.2.3-2 for FR2 NR cells.

Table B.2.3-1: Conditions for inter-frequency measurements in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP dBm / SCS_{SSB}		SSB Ês/Iot
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	dB
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-125	-122	≥ -4
	NR_FDD_FR1_B	-124.5	-121.5	
	NR_TDD_FR1_C	-124	-121	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-124.5	-120.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-123	-120	
	NR_FDD_FR1_F	-122.5	-119.5	
	NR_FDD_FR1_G	-122	-119	
	NR_FDD_FR1_H	-121.5	-118.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.3-2: Conditions for inter-frequency measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3 dBm / SCS_{SSB}					SSB Ês/Iot
			SCS_{SSB} = 120 kHz				SCS_{SSB} = 240 kHz	dB
			UE power class				UE power class	
			1	2	3	4	1, 2, 3, 4	
Conditions	Rx Beam Peak	n257	$-126.3+Y_1$	-111.8	-110.1	$-125.8+Y_4$	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-4
		n258	$-126.3+Y_1$	-111.8	-110.1	$-125.8+Y_4$		
		n259			-106.5			
		n260	$-123.3+Y_1$		-107.5	$-123.8+Y_4$		
		n261	$-126.3+Y_1$	-111.8	-110.1	$-125.8+Y_4$		
	Spherical coverage Note 1	n257	$-118.3+Z_1$	-100.8	-99.2	$-116.8+Z_4$	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-4
		n258	$-118.3+Z_1$	-100.8	-99.2	$-116.8+Z_4$		
		n259			-93.7			
		n260	$-115.3+Z_1$		-94.9	$-111.8+Z_4$		
		n261	$-118.3+Z_1$	-100.8	-99.2	$-116.8+Z_4$		
NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met. NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise. NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].								

Editor's notes for Table B.2.3-2:

- The value of Y for power classes 1 and 4 is FFS, where Y_1 and Y_4 are the rough/fine beam gain differences in Rx beam peak direction for power classes 1 and 4 respectively

- The value of Z for power classes 1 and 4 is FFS, where Z_1, and Z_4 are the rough/fine beam gain differences in spherical coverage directions for power classes 1 and 4 respectively

B.2.4 Conditions for NR L1-RSRP reporting

B.2.4.1 Conditions for SSB based L1-RSRP reporting

This clause defines the following conditions for NR L1-RSRP measurement reporting and corresponding procedures performed based on SSBs: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.2.4.1-1 for FR1 NR cells.

The conditions are defined in Table B.2.4.1-2 for FR2 NR cells.

Table B.2.4.1-1: Conditions for SSB based L1-RSRP measurements in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-121	≥ -3
	NR_FDD_FR1_B	-123.5	-120.5	
	NR_TDD_FR1_C	-123	-120	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	
	NR_FDD_FR1_F	-121.5	-118.5	
	NR_FDD_FR1_G	-121	-118	
	NR_FDD_FR1_H	-120.5	-117.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.4.1-2: Conditions for SSB based L1-RSRP measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3					SSB Ês/Iot
			dBm / SCS_{SSB}					dB
			SCS_{SSB} = 120 kHz				SCS_{SSB} = 240 kHz	
			UE power class				UE power class	
			1	2	3	4	1, 2, 3, 4	
Conditions	Rx Beam Peak	n257	$-125.3+Y_1$	-110.8	-109.1	$-124.8+Y_4$	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-3
		n258	$-125.3+Y_1$	-110.8	-109.1	$-124.8+Y_4$		
		n259			-105.5			
		n260	$-122.3+Y_1$		-106.5	$-122.8+Y_4$		
		n261	$-125.3+Y_1$	-110.8	-109.1	$-124.8+Y_4$		
	Spherical coverage Note 1	n257	$-117.3+Z_1$	-99.8	-98.2	$-115.8+Z_4$	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-3
		n258	$-117.3+Z_1$	-99.8	-98.2	$-115.8+Z_4$		
		n259			-92.7			
		n260	$-114.3+Z_1$		-93.9	$-110.8+Z_4$		
		n261	$-117.3+Z_1$	-99.8	-98.2	$-115.8+Z_4$		
NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met. NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise. NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].								

Editor's notes for Table B.2.4.1-2:

- *The value of Y for power classes 1 and 4 is FFS, where Y_1 and Y_4 are the rough/fine beam gain differences in Rx beam peak direction for power classes 1 and 4 respectively*

- *The value of Z for power classes 1 and 4 is FFS, where Z_1 and Z_4 are the rough/fine beam gain differences in spherical coverage directions for power classes 1 and 4 respectively*

B.2.4.2 Conditions for CSI-RS based L1-RSRP reporting

This clause defines the following conditions for NR L1-RSRP measurement reporting and corresponding procedures performed based on CSI-RS: CSI-RS_RP and CSI-RS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.2.4.2-1 for FR1 NR cells.

The conditions are defined in Table B.2.4.2-2 for FR2 NR cells.

Table B.2.4.2-1: Conditions for CSI-RS based L1-RSRP measurements in FR1

Parameter	NR operating band groups Note1	Minimum CSI-RS_RP dBm / SCS_{CSI-RS}			CSI-RS Ês/Iot dB
		SCS_{CSI-RS} = 15 kHz	SCS_{CSI-RS} = 30 kHz	SCS_{CSI-RS} = 60 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A, NR_SDL_FR1_A	-124	-121	-118	≥ -3
	NR_FDD_FR1_B	-123.5	-120.5	-117.5	
	NR_TDD_FR1_C	-123	-120	-117	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-122.5	-119.5	-116.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-122	-119	-116	
	NR_FDD_FR1_F	-121.5	-118.5	-115.5	
	NR_FDD_FR1_G	-121	-118	-115	
	NR_FDD_FR1_H	-120.5	-117.5	-114.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.					

Table B.2.4.2-2: Conditions for CSI-RS based L1-RSRP measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum CSI-RS_RP Note 2, Note 3					CSI-RS Ês/Iot
			dBm / SCS_{CSI-RS}					dB
			SCS_{CSI-RS} = 60 kHz				SCS_{CSI-RS} = 120 kHz	
			UE power class				UE power class	
			1	2	3	4	1, 2, 3, 4	
Conditions	Rx Beam Peak	n257	$-128.3+Y_1$	-113.8	-112.1	$-127.8+Y_4$	(Value for SCS_{CSI-RS} = 60 kHz) +3dB	≥-3
		n258	$-128.3+Y_1$	-113.8	-112.1	$-127.8+Y_4$		
		n259			-108.5			
		n260	$-125.3+Y_1$		-109.5	$-125.8+Y_4$		
		n261	$-128.3+Y_1$	-113.8	-112.1	$-127.8+Y_4$		
	Spherical coverage Note 1	n257	$-120.3+Z_1$	-102.8	-101.2	$-118.8+Z_4$	(Value for SCS_{CSI-RS} = 60 kHz) +3dB	≥-3
		n258	$-120.3+Z_1$	-102.8	-101.2	$-118.8+Z_4$		
		n259			-95.7			
		n260	$-117.3+Z_1$		-96.9	$-113.8+Z_4$		
		n261	$-120.3+Z_1$	-102.8	-101.2	$-118.8+Z_4$		

NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.
NOTE 2: Values specified at the Reference point to give minimum CSI-RS Ês/Iot, with no applied noise.
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].

Editor's notes for Table B.2.4.2-2:

- The value of Y for power classes 1 and 4 is FFS, where Y_1 and Y_4 are the rough/fine beam gain differences in Rx beam peak direction for power classes 1 and 4 respectively

- The value of Z for power classes 1 and 4 is FFS, where Z_1 and Z_4 are the rough/fine beam gain differences in spherical coverage directions for power classes 1 and 4 respectively

B.2.5 Conditions for RRC connection release with redirection to NR

This clause defines the following conditions for RRC connection release with redirection to NR: SSB_RP and SSB Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.2.5-1 for FR1 NR cells.

The conditions are defined in Table B.2.5-2 for FR2 NR cells.

Table B.2.5-1: Conditions for for RRC connection release with redirection to NR in FR1

Parameter	NR operating band groups Note1	Minimum SSB_RP		SSB Ês/Iot
		dBm / SCS_{SSB}		dB
		SCS_{SSB} = 15 kHz	SCS_{SSB} = 30 kHz	
Conditions	NR_FDD_FR1_A, NR_TDD_FR1_A	-125	-122	≥ -4
	NR_FDD_FR1_B	-124.5	-121.5	
	NR_TDD_FR1_C	-124	-121	
	NR_FDD_FR1_D, NR_TDD_FR1_D	-124.5	-120.5	
	NR_FDD_FR1_E, NR_TDD_FR1_E	-123	-120	
	NR_FDD_FR1_F	-122.5	-119.5	
	NR_FDD_FR1_G	-122	-119	
	NR_FDD_FR1_H	-121.5	-118.5	
NOTE 1: NR operating band groups are defined in clause 3.5.2.				

Table B.2.5-2: Conditions for RRC connection release with redirection to NR in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SSB_RP Note 2, Note 3					SSB Ês/Iot
			dBm / SCS_{SSB}					dB
			SCS_{SSB} = 120 kHz				SCS_{SSB} = 240 kHz	
			UE power class				UE power class	
			1	2	3	4	1, 2, 3, 4	
Conditions	Rx Beam Peak	n257	$-126.3+Y_1$	-111.8	-110.1	$-125.8+Y_4$	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-4
		n258	$-126.3+Y_1$	-111.8	-110.1	$-125.8+Y_4$		
		n259			-106.5			
		n260	$-123.3+Y_1$		-107.5	$-123.8+Y_4$		
		n261	$-126.3+Y_1$	-111.8	-110.1	$-125.8+Y_4$		
	Spherical coverage Note 1	n257	$-118.3+Z_1$	-100.8	-99.2	$-116.8+Z_4$	(Value for SCS_{SSB} = 120 kHz) +3dB	≥-4
		n258	$-118.3+Z_1$	-100.8	-99.2	$-116.8+Z_4$		
		n259			-93.7			
		n260	$-115.3+Z_1$		-94.9	$-111.8+Z_4$		
		n261	-114.3	-100.8	-99.2	$-116.8+Z_4$		
NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met. NOTE 2: Values specified at the Reference point to give minimum SSB Ês/Iot, with no applied noise. NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].								

Editor's notes for Table B.2.5.2-2:

- The value of Y for power classes 1 and 4 is FFS, where Y_1 and Y_4 are the rough/fine beam gain differences in Rx beam peak direction for power classes 1 and 4 respectively

- The value of Z for power classes 1 and 4 is FFS, where Z_1 and Z_4 are the rough/fine

B.2.6 Void

B.2.6.1 Void

Table B.2.6.1-1: Void

Table B.2.6.1-2: Void

B.2.6.2 Void

B.2.7 Conditions for SRS-RSRP measurements

This clause defines the following conditions for SRS-RSRP measurement and corresponding procedures performed based on SRSs: SRS_RP and SRS Ês/Iot, applicable for a corresponding operating band.

The conditions are defined in Table B.2.7-1 for FR1 NR cells.

The conditions are defined in Table B.2.7-2 for FR2 NR cells.

Table B.2.7-1: Conditions for SRS-RSRP measurements in FR1

Parameter	NR operating band groups [Note1]	Minimum SRS_RP			SRS Ês/Iot
		dBm / SCS_{SRS}			dB
		SCS_{SRS} = 15 kHz	SCS_{SRS} = 30 kHz	SCS_{SRS} = 60 kHz	
Conditions	NR_TDD_FR1_A	-120	-117	-114	≥ 1
	NR_TDD_FR1_C	-119	-116	-113	
	NR_TDD_FR1_D	-118.5	-115.5	-112.5	
	NR_TDD_FR1_E	-118	-115	-112	
NOTE 1: NR operating band groups are defined in clause 3.5.2.					

Table B.2.7-2: Conditions for SRS-RSRP measurements in FR2

Parameter	Angle of arrival	NR operating bands	Minimum SRS_RP Note 2, Note 3					SRS Ês/Iot
			dBm / SCS_{SRS}					dB
			SCS_{SRS} = 60 kHz				SCS_{SRS} = 120 kHz	
			UE Power class				UE Power class	
			1	2	3	4	1, 2, 3, 4	
Conditions	Rx Beam Peak	n257	-124.5	-119.0	-115.3	-124.0	(Value for SCS_{SRS} = 60 kHz) +3dB	≥1
		n258	-124.5	-119.0	-115.3	-124.0		
		n260	-121.5		-112.7	-122.0		
		n261	-124.5	-119.0	-115.3	-124.0		
	Spherical coverage Note 1	n257	-116.5	-108.0	-104.4	-115.0	(Value for SCS_{SRS} = 60 kHz) +3dB	≥1
		n258	-116.5	-108.0	-104.4	-115.0		
		n260	-113.5		-100.1	-110.0		
		n261	-116.5	-108.0	-104.4	-115.0		
NOTE 1: Values based on EIS spherical coverage as defined in clause 7.3.4 of TS 38.101-2 [19]. Side condition applies for directions in which EIS spherical coverage requirement is met.								
NOTE 2: Values specified at the Reference point to give minimum SRS Ês/Iot, with no applied noise.								
NOTE 3: For UEs that support multiple FR2 bands, Rx Beam Peak values are increased by $\Delta MB_{P,n}$ and Spherical coverage values are increased by $\Delta MB_{S,n}$, the UE multi-band relaxation factor in dB specified in clause 6.2.1 of TS 38.101-2 [19].								

B.3 RRM Requirements Exceptions

B.3.1 Introduction

Annex B.3 covers exceptions for side conditions based on receiver sensitivity for CA, DC, and SUL.

B.3.2 Receiver sensitivity relaxation for CA

B.3.2.1 Receiver sensitivity relaxation for UE supporting CA in FR1

For a UE supporting inter-band carrier aggregation configuration with uplink in NR band, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in clause 7.3A.3 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

For a UE supporting CA configuration in FR1, the requirement in this clause applies for both SC and CA operation.

B.3.2.2 Receiver sensitivity relaxation for UE configured with CA in FR1

B.3.2.2.1 Inter-band carrier aggregation

For a UE configured with inter-band carrier aggregation with active uplink in NR band, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in clause 7.3A.3 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

If the relaxation Δ specified in this clause applies, then the relaxation specified in clause B.3.2.1 should not be applied.

B.3.2.2.2 Reference sensitivity exceptions due to UL harmonic interference for CA

In this clause, requirements exceptions are described for the UE configured with a band in FR1 when it is impacted by UL harmonic interference from another band in FR1 of the same CA configuration.

A relevant side condition (SSB_RP and Io) in a requirement shall be increased by the amount Δ=L2-L1, where L1 is the reference sensitivity level specified in clause 7.3.2 of TS 38.101-1 [18], and L2 is the reference sensitivity level based on the requirements in clause 7.3A.4 of TS 38.101-1 [18], when the following conditions are fulfilled,

- corresponding downlink component carriers on different NR bands are configured with CA and active,
- the upling is configured in the NR low operating band and is active,
- the uplink configuration is as specified in clause 7.3A.4 of TS 38.101-1 [18], and
- the exception requirements specified in clause 7.3A.4 of TS 38.101-1 [18] apply.

If the relaxation Δ specified in this clause applies, then the relaxation specified in clause B.3.2.1 should not be applied.

B.3.2.2.3 Reference sensitivity exceptions due to intermodulation interference due to 2UL CA

In this clause, requirements exceptions are described for the UE with an inter-band carrier aggregation with uplink assigned to two NR bands.

A relevant side condition (SSB_RP and Io) in a requirement shall be increased by the amount Δ=L2-L1, where L1 is the reference sensitivity level specified in clause 7.3.2 of TS 38.101-1 [18], and L2 is the reference sensitivity level based on the requirements in clause 7.3A.5 of TS 38.101-1 [18], when the following conditions are fulfilled,

- corresponding downlink component carriers on different bands are configured with CA and active,
- uplinks are assigned to two NR bands,
- the exception requirements specified in clause 7.3A.5 of TS 38.101-1 [18] apply.

If the relaxation Δ specified in this clause applies, then the relaxation specified in clause B.3.2.1 should not be applied.

B.3.2.3 Receiver sensitivity relaxation for UE supporting CA in FR2

B.3.2.4 Receiver sensitivity relaxation for UE configured with CA in FR2

B.3.2.4.1 Intra-band contiguous carrier aggregation

For a UE configured with intra-band contiguous carrier aggregation in NR band in FR2, if there is a relaxation of receiver sensitivity ΔR_{IB}>0 dB as defined in clause 7.3A.2.1 of TS 38.101-2 [19] depending on the aggregated channel bandwidth, the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB}$ defined for the corresponding downlink NR bands.

B.3.2.4.2 Intra-band non-contiguous carrier aggregation

For a UE configured with intra-band non-contiguous carrier aggregation in NR band in FR2, if there is a relaxation of receiver sensitivity ΔR_{IB}>0 dB as defined in clause 7.3A.2.1 of TS 38.101-2 [19] depending on the aggregated channel bandwidth, the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB}$ defined for the corresponding downlink NR bands.

B.3.3 Receiver sensitivity relaxation for DC

B.3.3.1 Receiver sensitivity relaxation for EN-DC

Editor’s note: TBD

B.3.3.2 Receiver sensitivity relaxation for NE-DC

Editor’s note: TBD

B.3.4 Receiver sensitivity relaxation for SUL

B.3.4.1 Receiver sensitivity relaxation for UE supporting SUL in FR1

For a UE supporting a SUL configuration in FR1, if there is a relaxation of receiver sensitivity $\Delta R_{IB,c}$>0 dB as defined in clause 7.3C.3 of TS 38.101-1 [18], the relevant side conditions specifying received power levels (SSB_RP and Io) shall be increased by the amount $\Delta=\Delta R_{IB,c}$ defined for the corresponding downlink NR bands.

For a UE supporting a SUL configuration in FR1, the requirement in this clause applies for both SC and SUL operation.

B.3.4.2 Receiver sensitivity relaxation for UE configured with SUL in FR1

B.3.4.2.1 Reference sensitivity exceptions due to UL harmonic interference for SUL

In this clause, requirements exceptions are described for the UE with a band in FR1 when it is impacted by UL harmonic interference from another band in FR1 of the same SUL configuration.

A relevant side condition (SSB_RP and Io) in a requirement shall be increased by the amount Δ=L2-L1, where L1 is the reference sensitivity level specified in clause 7.3.2 of TS 38.101-1 [18], and L2 is the reference sensitivity level based on the requirements in clause 7.3C.2 of TS 38.101-1 [18], when the following conditions are fulfilled,

- a downlink component carrier is configured in NR band and is active,
- the upling is configured in the NR low operating band and is active,
- the uplink configuration is as specified in clause 7.3C.2 of TS 38.101-1 [18], and
- the exception requirements specified in clause 7.3C.2 of TS 38.101-1 [18] apply.

If the relaxation Δ specified in this clause applies, then the relaxation specified in clause B.3.4.1 should not be applied.

Annex C (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2017-05	RAN4#83	R4-1706324				Specification skeleton	0.0.1
2017-09						Email approved	0.1.0
2017-09	RAN4-NR AH #3	R4-1709413				Capture TPs approved in the meeting	0.2.0
2017-10	RAN4#84 -Bis	R4-1711985				Capture TPs approved in the meeting	0.3.0
2017-12	RAN4#85	R4-1714546				Capture TPs approved in RAN4#85	0.4.0
2017-12	RAN#78	RP-172407				v1.0.0 submitted for plenary approval	1.0.0
2017-12	RAN#78					Approved by plenary – Rel-15 spec under change control	15.0.0
2018-03	RAN#79	RP-180264	0032		B	CR to TS38.133	15.1.0
2018-06	RAN#80	RP-181075	0037		B	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4 #86bis and RAN4 #87	15.2.0
2018-09	RAN#81	RP-181896	0043		B	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4-AH-1807 and RAN4 #88	15.3.0
2018-12	RAN#82	RP-182763	0057	3	B	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4-88bis and RAN4-89	15.4.0
2019-03	RAN#83	RP-190569	0064	1	B	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4#90	15.5.0
2019-06	RAN#84	RP-191240	0072	1	F	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4#90bis and RAN4#91	15.6.0
2019-06	RAN#84	RP-191248	0066		B	Introduction of band n48	16.0.0
2019-06	RAN#84	RP-191242	0067		B	Introduction of band n14 - CR to TS 38.133	16.0.0
2019-06	RAN#84	RP-191246	0068		B	Introduction of band n30 - CR to TS 38.133	16.0.0
2019-06	RAN#84	RP-191244	0069		B	introduce n18 into TS38.133	16.0.0
2019-06	RAN#84	RP-191250	0070	1	B	n65 introduction to 38.133	16.0.0
2019-09	RAN#85	RP-192034	0077		B	n29 introduction to 38.133	16.1.0
2019-09	RAN#85	RP-192022	0085		A	CR to TS 38.133: Implementation of endorsed draft CRs from RAN4#92 (Rel-16) - Mirrors changes in R4-1910356 for Rel-15 TS 38.133	16.1.0
2019-12	RAN#86	RP-192997	0093		A	Specification of UE antenna gain range	16.2.0
2019-12	RAN#86	RP-192992	0095	1	A	Add RRM Test case setup for 1 AoA in Rx beam peak and 1 in non Rx beam peak	16.2.0
2019-12	RAN#86	RP-192997	0097		A	Update of Parameters, Test case A.7.7.1.1 FR2 Intra-frequency SS-RSRP accuracy	16.2.0
2019-12	RAN#86	RP-192997	0099		A	Update of Parameters, Test case A.5.7.1.1 FR2 Intra-frequency SS-RSRP accuracy	16.2.0
2019-12	RAN#86	RP-192997	0101		A	Update of Parameters, Test case A.7.7.1.2 FR2 Inter-frequency SS-RSRP accuracy	16.2.0
2019-12	RAN#86	RP-192997	0103		A	Update of Parameters, Test case A.5.7.1.2 FR2 Inter-frequency SS-RSRP accuracy	16.2.0
2019-12	RAN#86	RP-192992	0105		A	Correction to Random access test case in FR1 for PSCell in EN-DC	16.2.0
2019-12	RAN#86	RP-193040	0107		A	CR on handover 38.133 - R16	16.2.0
2019-12	RAN#86	RP-192994	0112	1	A	CR on the BWP switch test cases EN-DC FR1 (clause A.4.5.6)	16.2.0
2019-12	RAN#86	RP-192994	0113	1	A	CR on the BWP switch test cases EN-DC FR2 (clause A.5.5.6)	16.2.0
2019-12	RAN#86	RP-192994	0114	1	A	CR on the BWP switch test cases SA FR1 (clause A.6.5.6)	16.2.0
2019-12	RAN#86	RP-192994	0115	1	A	CR on the BWP switch test cases SA FR2 (clause A.7.5.6)	16.2.0
2019-12	RAN#86	RP-193042	0117		A	CR to TS38.133 on correction for BWP switching with SCS changing (Section 8.2.1.2.7, 8.2.2.2.5 and 8.6.2)	16.2.0
2019-12	RAN#86	RP-193040	0121		A	CR on handover RRM requirement (clause 6.1.1.5) (R16)	16.2.0
2019-12	RAN#86	RP-192994	0123		A	CR on test cases for EN-DC FR2 inter-frequency measurement (clause A.5.6.2) (R16)	16.2.0
2019-12	RAN#86	RP-192994	0127	1	A	CR on test cases for Redirection from NR in FR2 to NR in FR2 (clause A.7.3.2.3) (R16)	16.2.0
2019-12	RAN#86	RP-192994	0129	1	A	CR on test cases for FR2 handover (clause A.7.3.1) (R16)	16.2.0
2019-12	RAN#86	RP-193042	0131		A	CR to 38.133 on TCI state switching (Section 8.10) (R16)	16.2.0
2019-12	RAN#86	RP-193009	0133		F	CR on measurement gap applicability requirement for SRVCC	16.2.0
2019-12	RAN#86	RP-192994	0137		A	CR on TC with monitoring PDCCH not in first 3 OFDM symbols R16	16.2.0
2019-12	RAN#86	RP-193021	0139		F	CR to add n90 in the NR operating bands in FR1 (3.5.2)	16.2.0
2019-12	RAN#86	RP-193040	0148	1	A	CR on inter-RAT measurement in TS38.133 (clause 9.4.2, 9.4.3)	16.2.0
2019-12	RAN#86	RP-193042	0151		A	CR to 38.133 R16 Add the missing units to DRX cycle values (Cat A)	16.2.0
2019-12	RAN#86	RP-193005	0152	1	B	CR for Abbreviations for cross link interference (clause 3)	16.2.0
2019-12	RAN#86	RP-193005	0153	1	B	CR for cross link interference measurements (clause 9)	16.2.0
2019-12	RAN#86	RP-193041	0156		A	CR on NR MTTD and MRTD definition for R16	16.2.0
2019-12	RAN#86	RP-193042	0157	1	A	Editorial correction for SCell activation and deactivation delay	16.2.0
2019-12	RAN#86	RP-193039	0159		A	CR for SCell activation delay in FR2	16.2.0
2019-12	RAN#86	RP-193040	0161		A	CR for scheduling restriction due to L1-RSRP measurement	16.2.0
2019-12	RAN#86	RP-192993	0167		A	CR on SSB setting for new gap and SMTC setting (Section A.3.10)	16.2.0

2019-12	RAN#86	RP-192995	0169		A	CR on TS38.133 for EN-DC SS-SINR tests with PSCell in FR1 (Section A.4.7.3)	16.2.0
2019-12	RAN#86	RP-192995	0171		A	CR on TS38.133 for SA SS-SINR tests with PCell in FR1 (Section A.6.7.3)	16.2.0
2019-12	RAN#86	RP-192993	0185		A	CR on cell-reselection test cases for NR SA FR2 R16	16.2.0
2019-12	RAN#86	RP-192995	0187		A	endorsed CR on intra-frequency measurement and reporting for EN-DC FR2 R16	16.2.0
2019-12	RAN#86	RP-192996	0189		A	endorsed CR on intra-frequency measurement and reporting for NR SA FR2 R16	16.2.0
2019-12	RAN#86	RP-192996	0191		A	endorsed CR on RLM scheduling restrictions for EN-DC FR2 R16	16.2.0
2019-12	RAN#86	RP-192996	0193		A	endorsed CR on RLM scheduling restrictions for NR SA FR2 R16	16.2.0
2019-12	RAN#86	RP-192992	0201		A	Correction to PRACH configuration index in test cases_r16	16.2.0
2019-12	RAN#86	RP-193009	0205		B	CR on UMTS inter-RAT measurement requirements	16.2.0
2019-12	RAN#86	RP-193009	0206		B	CR on CSSF for SRVCC	16.2.0
2019-12	RAN#86	RP-193009	0207		B	CR on measurement capability for NR- UMTS for SRVCC	16.2.0
2019-12	RAN#86	RP-193039	0209		A	Correction on the TCI state switching (clause 8.10)	16.2.0
2019-12	RAN#86	RP-193039	0219		A	CR for 38133 editorial for clause 8.1,8.8,8.9,8.10,8.11 in Rel-16	16.2.0
2019-12	RAN#86	RP-193039	0220		A	CR for 38133 editorial for clause 8.5 in Rel-16	16.2.0
2019-12	RAN#86	RP-193039	0221		A	CR for 38133 editorial for clause 9.3 in Rel-16	16.2.0
2019-12	RAN#86	RP-193040	0222		A	CR on 38133 for removal the duplicated reference in clause 2	16.2.0
2019-12	RAN#86	RP-193040	0223		A	CR on 38133 for clause 11 in Rel-16	16.2.0
2019-12	RAN#86	RP-192994	0225	1	A	CR on TC of UE transmit timing (A.4.4.1.1, A.5.4.1.1, A.6.4.1.1, A.7.4.1.1) Rel-16	16.2.0
2019-12	RAN#86	RP-193042	0230		A	Update on requirements related to inter-band EN-DC and NE-DC synchronous requirements	16.2.0
2019-12	RAN#86	RP-193008	0231	1	B	MRTD and MTTD requirements for asynchronous NR-NR DC	16.2.0
2019-12	RAN#86	RP-192995	0233	1	A	Editorial corrections to measurement accuracy tests	16.2.0
2019-12	RAN#86	RP-192992	0235		A	Corrections to SS-RSRQ and SS-SINR OTA tests with SA	16.2.0
2019-12	RAN#86	RP-192992	0237	1	A	Corrections to SS-RSRQ and SS-SINR OTA tests with EN-DC	16.2.0
2019-12	RAN#86	RP-193042	0239	1	A	Editorial corrections to clause 9.2	16.2.0
2019-12	RAN#86	RP-193009	0240		B	Introduction of handover requirements for SRVCC in clause 6.1.2	16.2.0
2019-12	RAN#86	RP-192992	0242		A	Corrections to band applicability of measurement accuracy tests	16.2.0
2019-12	RAN#86	RP-192996	0244		A	Introduction of bandwidth limited OCNG for OTA testing	16.2.0
2019-12	RAN#86	RP-192992	0248		A	Corrections to test cases for SA FR2 inter-frequency measurement (clause A.7.6.2)	16.2.0
2019-12	RAN#86	RP-193041	0250		A	CR to 38.133 NR reporting criteria	16.2.0
2019-12	RAN#86	RP-192993	0264		A	CR on correcting CSI-RS based BFD and link recovery tests for EN-DC in FR1	16.2.0
2019-12	RAN#86	RP-192993	0266		A	CR on correcting CSI-RS based BFD and link recovery tests for SA in FR1	16.2.0
2019-12	RAN#86	RP-192993	0268		A	CR on correcting CSI-RS based BFD and link recovery tests for EN-DC in FR2	16.2.0
2019-12	RAN#86	RP-192993	0270		A	CR on correcting CSI-RS based BFD and link recovery tests for SA in FR2	16.2.0
2019-12	RAN#86	RP-193004	0274	1	B	CR on introducing L1-SINR mapping in TS38.133 R16	16.2.0
2019-12	RAN#86	RP-193040	0276		A	CR on delay uncertainty of RRC Release with redirection requirements in TS 38.133 (Cat A)	16.2.0
2019-12	RAN#86	RP-193040	0278		A	CR on known condition of PSCell addition requirement in NE-DC (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0280		A	CR on known condition of PSCell addition requirement in NR DC (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0282		A	CR on RRC Re-establishment requirements in TS 38.133 (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0284		A	CR on scope of interruption requirements of EN-DC in TS 38.133 (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0286		A	CR on scope of MTTD requirements in TS 38.133 (Cat A)	16.2.0
2019-12	RAN#86	RP-192994	0288		A	CR on SSB-based RLM test case for EN-DC FR1 (Cat A)	16.2.0
2019-12	RAN#86	RP-192994	0290		A	CR on SSB-based RLM test case for NR SA FR1 (Cat A)	16.2.0
2019-12	RAN#86	RP-193042	0292		A	Editorial CR on clause 8.2 (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0296		A	CR on NR inter-frequency identification (Cat A)	16.2.0
2019-12	RAN#86	RP-193041	0298		A	CR on NR intra-frequency measurements (Cat A)	16.2.0
2019-12	RAN#86	RP-193039	0312		A	Correction on CSSF within measurement gap (clause 9.1.5.2) (cat-A)	16.2.0
2019-12	RAN#86	RP-193041	0314		A	CR on RLM scheduling restriction (clause 8.1.7) (cat-A)	16.2.0
2019-12	RAN#86	RP-193041	0316		A	CR on SCell activation requirements (clause 8.3.2) (cat-A)	16.2.0
2019-12	RAN#86	RP-193042	0318		A	CR to add QCL definition (clause 3.6) (cat-A)	16.2.0
2019-12	RAN#86	RP-192993	0320		A	CR on power offset in TRS RMC (A.3.17) (cat-A)	16.2.0
2019-12	RAN#86	RP-192995	0322		A	CR to introduce new PDCCH RMC (A.3.1.3.2) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0324		A	Maintenance CR for measurement accuracy (clause 10.1) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0326		A	FR1 CSI-RS RLM test OOS/IS non-DRX for EN-DC (clause A.4.5.1) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0328		A	FR2 CSI-RS RLM test OOS/IS non-DRX for EN-DC (clause A.4.5.1) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0330		A	FR1 CSI-RS RLM test OOS/IS non-DRX for SA (clause A.6.5.1) (cat-A)	16.2.0

2019-12	RAN#86	RP-192996	0332		A	FR2 CSI-RS RLM test OOS/IS non-DRX for SA (clause A.6.5.1) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0334		A	L1-RSRP delay test FR1 EN-DC (clause A.4.6.3) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0336		A	L1-RSRP delay test FR2 EN-DC (clause A.5.6.3) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0338		A	L1-RSRP delay test FR1 SA (clause A.6.6.4) (cat-A)	16.2.0
2019-12	RAN#86	RP-192997	0340		A	L1-RSRP delay test FR2 SA (clause A.7.6.3) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0344		A	L1-RSRP accuracy test FR2 EN-DC (clause A.5.7.4) (cat-A)	16.2.0
2019-12	RAN#86	RP-192996	0346		A	L1-RSRP accuracy test FR2 SA (clause A.7.7.4) (cat-A)	16.2.0
2019-12	RAN#86	RP-193005	0347	1	B	CR to introduce CLI measurement accuracy requirements	16.2.0
2019-12	RAN#86	RP-193008	0348		B	CR on measurement gap interruption due to async NR-DC	16.2.0
2019-12	RAN#86	RP-193008	0349		B	CR on Interruptions at PSCell/SCell addition/release in async NR-DC	16.2.0
2019-12	RAN#86	RP-193008	0350		B	Introducing euCA related interruption requirements for EN-DC in 38.133 (clause 8.2.1)	16.2.0
2019-12	RAN#86	RP-193008	0351		B	Introducing euCA related interruption requirements for NE-DC in 38.133 (clause 8.2.3)	16.2.0
2019-12	RAN#86	RP-193008	0352	1	B	CR on direct SCell activation delay	16.2.0
2019-12	RAN#86	RP-193039	0358		A	CR 38.133 (8.3.2) Amendment of requirements depending on T_SMTC_Max	16.2.0
2019-12	RAN#86	RP-193039	0360		A	CR 38.133 (8.3.3) Correction of SCell deactivation delay	16.2.0
2019-12	RAN#86	RP-192992	0362	1	A	CR 38.133 (A.7.5.7) TCs for PSCell addition and release delay	16.2.0
2019-12	RAN#86	RP-192995	0366		A	CR to TS 38.133: New common clause with OTA related definitions for FR2 testing (Rel-16)	16.2.0
2019-12	RAN#86	RP-192995	0368		A	CR to TS 38.133: Configuration of NR FR1 cell in NR FR1-FR2 tests (Rel-16)	16.2.0
2019-12	RAN#86	RP-192995	0370		A	CR to TS 38.133: Clarificatins to Antenna Configurations for FR2 (Rel-16)	16.2.0
2019-12	RAN#86	RP-192995	0372		A	CR to TS 38.133: Corrections to CORESET RMCs (Rel-16)	16.2.0
2019-12	RAN#86	RP-192995	0374		A	CR to TS 38.133: Corrections to FR2 test configurations (Rel-16)	16.2.0
2019-12	RAN#86	RP-193042	0376	1	A	Editorial updates (clause 9.4)	16.2.0
2019-12	RAN#86	RP-193039	0378		A	Correction in interruption requirements (clause 8.2)	16.2.0
2019-12	RAN#86	RP-193042	0380	1	A	Editorial updates (Annex B)	16.2.0
2019-12	RAN#86	RP-193040	0382		A	CR on 38133 for MRTD and MTTD in intra-band EN-DC	16.2.0
2019-12	RAN#86	RP-193039	0390		A	Correction to the starting point of the DRX cycle length interval	16.2.0
2019-12	RAN#86	RP-192992	0391		A	CR for MAC-CE based TCI State switch for ENDC (Section A.5.5.8)	16.2.0
2019-12	RAN#86	RP-192993	0392		A	CR for MAC-CE based TCI State switch for NR SA (Section A.7.5.7)	16.2.0
2019-12	RAN#86	RP-192993	0393		A	CR for RRC based TCI State switch for NR SA (Section A.7.5.7)	16.2.0
2019-12	RAN#86	RP-192993	0394		A	CR for RRC based TCI State switch for EN-DC (Section A.5.5.8)	16.2.0
2019-12	RAN#86	RP-192992	0395		A	CR for FR1 handover test cases (Section A.6.3.1.1, A.6.3.1.2, A.6.3.1.3)	16.2.0
2019-12	RAN#86	RP-193041	0396		A	CR on MTTD for intra-band EN-DC	16.2.0
2019-12	RAN#86	RP-193040	0398		A	CR on corrections on NR intra frequency measurement reporting requirements (Section 9.2.4)	16.2.0
2020-03	RAN#87	RP-200401	0405	1	A	[CR] handover requirements 38.133 R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0412	1	A	[CR] SCell activation delay 38.133 R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0417		A	Corrections to RRM Test case A.7.1.1.2	16.3.0
2020-03	RAN#87	RP-200401	0419		A	Correction to Active UL BWP for SA intra-frequency event triggered reporting with per-UE gaps	16.3.0
2020-03	RAN#87	RP-200401	0421		A	Correction to FR1-E-UTRA Inter-RAT cell re-selection test cases	16.3.0
2020-03	RAN#87	RP-200401	0423		A	Removal of Time offset between PCell and PSCell in SA RRM Test cases	16.3.0
2020-03	RAN#87	RP-200401	0425		A	Correction to SRS periodicity and Offset for UL transit timing with DRx config	16.3.0
2020-03	RAN#87	RP-200401	0427		A	Update of Test Requirements, FR2 Intra-frequency SS-RSRP accuracy Test cases	16.3.0
2020-03	RAN#87	RP-200401	0429		A	Update of Test requirements, FR2 Inter-frequency SS-RSRP accuracy Test cases	16.3.0
2020-03	RAN#87	RP-200401	0439	1	A	CR on test cases for SA FR2 inter-frequency measurement R16 (section A.7.6.2)	16.3.0
2020-03	RAN#87	RP-200401	0441		A	Editorial corrections for 38.133 Core Part R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0445	1	A	Editorial corrections for 38.133 Perf Part R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0454		A	Editorial correction for active TCI state switching delay	16.3.0
2020-03	RAN#87	RP-200401	0462	1	A	Corrections for BWP switch delay R16 (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0464		A	CR for reference correction on L1-RSRP measurement period (section 9.5.3)	16.3.0
2020-03	RAN#87	RP-200401	0466		A	CR for measurement restriction in FR2 across CCs (section 8.1.2.3, 8.1.3.3, 8.5.2.3, 8.5.3.3, 8.5.5.3, 8.5.6.3, 9.5.5.1, 9.5.5.2)	16.3.0
2020-03	RAN#87	RP-200401	0468		A	CR for SSB based candidate beam detection (section 8.5.5.2)	16.3.0
2020-03	RAN#87	RP-200401	0488		A	CR to TS 38.133: Corrections to FR1-FR2 event triggered test cases Annex A.5 (Rel-16)	16.3.0
2020-03	RAN#87	RP-200401	0490		A	CR to TS 38.133: Corrections to FR1-FR2 event triggered test cases Annex A.7 (Rel-16)	16.3.0

2020-03	RAN#87	RP-200401	0492		A	CR to TS 38.133: Clarifications to AoA setup and AoA cell assignement Annex A.5 (Rel-16)	16.3.0
2020-03	RAN#87	RP-200401	0494		A	CR to TS 38.133: Clarifications to AoA setup Annex A.8 (Rel-16)	16.3.0
2020-03	RAN#87	RP-200401	0496		A	CR to TS 38.133: Addition of TC A.4.7.2.2 (Rel-16)	16.3.0
2020-03	RAN#87	RP-200401	0500		A	Editorial correction of EN-DC FR1 L1-RSRP measurement for beam reporting	16.3.0
2020-03	RAN#87	RP-200401	0502		A	Editorial correction of NR SA FR1 L1-RSRP measurement for beam reporting	16.3.0
2020-03	RAN#87	RP-200401	0509		A	CR on removing one-shot timing adjustment requirements (Cat A)	16.3.0
2020-03	RAN#87	RP-200401	0516		A	Correction to BWP switching delay_r16	16.3.0
2020-03	RAN#87	RP-200401	0518		A	Correction to inter-RAT measurement on LTE serving carrrier_r16	16.3.0
2020-03	RAN#87	RP-200401	0520		A	Correction to configurations for TRS_r16	16.3.0
2020-03	RAN#87	RP-200401	0522		A	Correction to FR1 SA inter-RAT measurement TCs_r16 NOTE The CR is not implemented because the corresponding Cat F CR is not implementable.	16.3.0
2020-03	RAN#87	RP-200401	0524		A	Correction to interruption TCs_r16 NOTE The CR is not implemented because the corresponding Cat F CR is not implementable.	16.3.0
2020-03	RAN#87	RP-200401	0528		A	Correction to RF channels configuration_r16	16.3.0
2020-03	RAN#87	RP-200401	0530		A	Correction to RRC release with redirection TCs_r16	16.3.0
2020-03	RAN#87	RP-200401	0532		A	Correction to UL reconfiguration delay TCs_r16	16.3.0
2020-03	RAN#87	RP-200401	0538		A	CR on SSB RLM test cases EN-DC R16	16.3.0
2020-03	RAN#87	RP-200401	0540		A	CR on SSB RLM test cases SA R16	16.3.0
2020-03	RAN#87	RP-200401	0542		A	CR on cell reselection test cases for FR2 SA R16	16.3.0
2020-03	RAN#87	RP-200401	0544		A	OCNG pattern for TDM-ed SSB R16	16.3.0
2020-03	RAN#87	RP-200401	0564		A	NR editorial correction	16.3.0
2020-03	RAN#87	RP-200401	0580		A	CR 38.133 (8.11) Corrections to PSCell change delay requirements	16.3.0
2020-03	RAN#87	RP-200401	0587		A	PRACH configurations in FR1 SSB based RLM tests	16.3.0
2020-03	RAN#87	RP-200401	0589		A	PRACH configurations in FR1 SSB based BFR tests	16.3.0
2020-03	RAN#87	RP-200375	0437	1	B	CR for Conditional PSCell addition/change RRM requirement	16.3.0
2020-03	RAN#87	RP-200381	0440		B	n26 introduction to 38.133	16.3.0
2020-03	RAN#87	RP-200374	0452	1	B	CR on interruption requirements for NR V2X	16.3.0
2020-03	RAN#87	RP-200372	0455		B	CR on RRM requirement for maximum MIMO layer adaptation	16.3.0
2020-03	RAN#87	RP-200389	0460	1	F	introduce n18 into TS38.133	16.3.0
2020-03	RAN#87	RP-200374	0473	1	B	CR of NR V2X RRM(introduction & reliability of GNSS signal)	16.3.0
2020-03	RAN#87	RP-200374	0476	2	B	CR on NR V2X initiation SLSS 38.133 -R16	16.3.0
2020-03	RAN#87	RP-200401	0479		F	CR to 38.133 NR reporting criteria	16.3.0
2020-03	RAN#87	RP-200382	0486		B	Introduction of n53 into 38.133	16.3.0
2020-03	RAN#87	RP-200371	0498		B	Updates to SA NR interruption requirements for NR-U	16.3.0
2020-03	RAN#87	RP-200401	0510		F	CR on inter-band EN-DC and NE-DC synchronous requirements	16.3.0
2020-03	RAN#87	RP-200375	0511	1	B	CR on DAPS handover requirements	16.3.0
2020-03	RAN#87	RP-200374	0512		B	CR on introducing UE sidelink timing requirements for NR V2X	16.3.0
2020-03	RAN#87	RP-200370	0545	1	F	CR on CLI measurement requirements	16.3.0
2020-03	RAN#87	RP-200370	0546	1	F	CR on CLI measurement accuracy requirements	16.3.0
2020-03	RAN#87	RP-200406	0547		B	CR on Interruptions at SCell activation/deactivation in async NR-DC	16.3.0
2020-03	RAN#87	RP-200406	0548	1	F	CR on direct SCell activation delay	16.3.0
2020-03	RAN#87	RP-200376	0551	1	F	Correction on handover requirements for SRVCC	16.3.0
2020-03	RAN#87	RP-200371	0558	1	B	CR to 38.133 to address NR-U inter-RAT measurements	16.3.0
2020-03	RAN#87	RP-200401	0578		F	CR 38.133 (8.3.2) Correction of error in Rel-16 SCell activation	16.3.0
2020-03	RAN#87	RP-200370	0582		B	CR for conditions for cross link interference measurements (section B)	16.3.0
2020-06	RAN#88	RP-200987	0595		A	[CR] Editorial corrections for 38.133 R16 Core Part - Cat A	16.4.0
2020-06	RAN#88	RP-200987	0596		F	[CR] Editorial corrections for 38.133 R16 Core Part - Cat F	16.4.0
2020-06	RAN#88	RP-200987	0598		A	[CR] Editorial corrections for 38.133 R16 Perf Part - Cat A	16.4.0
2020-06	RAN#88	RP-200966	0599		F	[CR] Delay requirements for direct SCell activation	16.4.0
2020-06	RAN#88	RP-200987	0600		F	[CR] Editorial corrections for 38.133 R16 Perf Part - Cat F	16.4.0
2020-06	RAN#88	RP-200987	0602		A	CR to Intra-frequency handover from FR1 to FR1	16.4.0
2020-06	RAN#88	RP-200987	0606		A	CR to A.6.1.2.1 Cell reselection to higher priority E-UTRAN	16.4.0
2020-06	RAN#88	RP-200987	0608		A	Correction to General test parameters in A.6.6.1.2	16.4.0
2020-06	RAN#88	RP-200987	0620		A	CR on CSSF correction for R16 TS38.133	16.4.0
2020-06	RAN#88	RP-201047	0625	1	B	CR on multiple SCell activation deactivation requirement for R16	16.4.0
2020-06	RAN#88	RP-201047	0626	1	B	CR on multiple SCell activation interruption requirement for R16	16.4.0
2020-06	RAN#88	RP-200987	0629		A	CR on Active TCI State Switching requirements - Rel16	16.4.0
2020-06	RAN#88	RP-201055	0632	2	F	Rapportuer CR for TS38.133	16.4.0
2020-06	RAN#88	RP-201048	0635	2	B	CR on minimum requirement at transition period for UE power saving	16.4.0
2020-06	RAN#88	RP-200958	0636	1	F	CR on interruption requirements for NR V2X	16.4.0
2020-06	RAN#88	RP-200975	0641	1	B	CR on cell identification requirements for NR HST	16.4.0

2020-06	RAN#88	RP-201044	0642	2	B	CR on PRS-RSRP measurement report mapping	16.4.0
2020-06	RAN#88	RP-201044	0645	1	B	CR on SRS RSRP measurement report mapping	16.4.0
2020-06	RAN#88	RP-200973	0646	2	B	CR to TS38.133 on introduction of L1-SINR Measurement Requirement (Section 3.3 and 9)	16.4.0
2020-06	RAN#88	RP-200973	0648	1	B	CR to TS38.133 on introduction of SCell BFRQ Procedure (Section 8.5)	16.4.0
2020-06	RAN#88	RP-200987	0651		A	Add UE Beam assumption for RRM Test cases in A.7.3, A.7.4, A.7.7	16.4.0
2020-06	RAN#88	RP-200987	0653		A	Add UE Beam assumption for RRM Test cases in A.5.3, A.5.4, A.5.7	16.4.0
2020-06	RAN#88	RP-200987	0655		A	Update of FR2 RLM Test cases with 2 Angles of Arrival	16.4.0
2020-06	RAN#88	RP-200987	0657		F	Update of Tx Timing Test cases	16.4.0
2020-06	RAN#88	RP-200987	0659		A	Update of FR2 RLM and BFD-LR Test cases	16.4.0
2020-06	RAN#88	RP-200987	0661		A	Update of FR2 SS-RSRP Test cases	16.4.0
2020-06	RAN#88	RP-200987	0663	1	A	CR on TCI state switch	16.4.0
2020-06	RAN#88	RP-200987	0665		A	CR on PDSCH RMC	16.4.0
2020-06	RAN#88	RP-201047	0668	1	B	CR on active spatial relation switch	16.4.0
2020-06	RAN#88	RP-200976	0671	1	B	CR to TS 38.133: CHO RRM requirement	16.4.0
2020-06	RAN#88	RP-201047	0672	1	B	CR to TS 38.133: RRM requirement for UE-specific CBW change delay	16.4.0
2020-06	RAN#88	RP-201047	0673		B	CR to TS 38.133: RRM requirement for interruption due to UE-specific CBW change	16.4.0
2020-06	RAN#88	RP-200969	0678	1	B	CR to TS 38.133: introducing 2-step RACH core requirements	16.4.0
2020-06	RAN#88	RP-200987	0680		A	Correction of CFRA RSRP threshold	16.4.0
2020-06	RAN#88	RP-200970	0682		B	CR for event triggered reporting tests for CLI	16.4.0
2020-06	RAN#88	RP-200958	0685		B	CR of NR V2X abbreviations	16.4.0
2020-06	RAN#88	RP-200958	0686	1	B	CR of interruption for switching between NR SL and LTE SL	16.4.0
2020-06	RAN#88	RP-200958	0687	2	F	CR of NR V2X editorial correction	16.4.0
2020-06	RAN#88	RP-200971	0689	1	B	38.133 CR on cell re-selection requirements for Rel-16 NR HST	16.4.0
2020-06	RAN#88	RP-201047	0690	1	B	CR on introducing inter-frequency measurements without measurement gap (9.1.5, 9.1.6, 9.3.1, 9.3.4, 9.3.5)	16.4.0
2020-06	RAN#88	RP-200987	0696		A	CR on SMTC period for beam management requirements	16.4.0
2020-06	RAN#88	RP-200987	0698		A	CR for CSI-RS based L1-RSRP measurement period	16.4.0
2020-06	RAN#88	RP-200987	0700		A	CR on RACH test cases with CSI-RS resource R16	16.4.0
2020-06	RAN#88	RP-200987	0704		A	CR on TS38.133 for modification of the layer 3 and layer 1 measurement sharing factor when both SSB and RSSI symbol to be measured are considered	16.4.0
2020-06	RAN#88	RP-200987	0706		A	CR on TS38.133 for modification on number of cells and number of SSB to be measured for FR2 intra-frequency measurement	16.4.0
2020-06	RAN#88	RP-200987	0708		A	[CR] TCI state switch delay 38.133 R16 Cat A	16.4.0
2020-06	RAN#88	RP-201047	0709	1	F	LTE CGI measurements with autonomous gaps for 38.133	16.4.0
2020-06	RAN#88	RP-201042	0710	3	B	Updates to general section for NR-U in 38.133	16.4.0
2020-06	RAN#88	RP-200976	0711	1	F	Correction to DAPS HO requirements in 38.133	16.4.0
2020-06	RAN#88	RP-201049	0712	2	F	SRVCC test case for event triggered reporting	16.4.0
2020-06	RAN#88	RP-201049	0713		F	Gap applicability errors corrected for SRVCC	16.4.0
2020-06	RAN#88	RP-200987	0715		A	Correction of NR SA FR2 inter-freq measurement reporting	16.4.0
2020-06	RAN#88	RP-200968	0717		F	NTA_offset setting for NR coexistence with NB-IoT	16.4.0
2020-06	RAN#88	RP-201042	0718	2	B	CR to TS 38.133: adding NR-U Handover.	16.4.0
2020-06	RAN#88	RP-200975	0723	1	B	CR on cell re-selection requirement for NR-EUTRAN measurement in TS38.133	16.4.0
2020-06	RAN#88	RP-201042	0725	1	B	CR: Introduction of L1-RSRP measurement requirements with CCA	16.4.0
2020-06	RAN#88	RP-200987	0727		A	CR: Correction of L1-RSRP measurement period	16.4.0
2020-06	RAN#88	RP-200987	0729		A	CR to TS 38.133: Correction to CSI-RS configurations in A.3.14 (Rel-16)	16.4.0
2020-06	RAN#88	RP-200987	0731		A	CR to TS 38.133: Correction to SMTC configuration in measurement accuracy tests (Rel-16)	16.4.0
2020-06	RAN#88	RP-200987	0733		A	CR to TS 38.133: Clarifications to AoA setup Annex A.5 (Rel-16)	16.4.0
2020-06	RAN#88	RP-200987	0735		A	CR to TS 38.133: Clarifications to AoA setup Annex A.7 (Rel-16)	16.4.0
2020-06	RAN#88	RP-201048	0736		F	CR for maximum MIMO layer adaptation	16.4.0
2020-06	RAN#88	RP-200987	0738	1	F	Applicability of QCL	16.4.0
2020-06	RAN#88	RP-201047	0741	1	B	CR to 38.133 on SRS carrier switching interruption requirements	16.4.0
2020-06	RAN#88	RP-201047	0742	1	B	CR to 38.133 on impact to measurement requirements due to LTE SRS carrier switching	16.4.0
2020-06	RAN#88	RP-200969	0743	1	B	CR to 38.133 on UE transmit timing requirements for 2-step RACH	16.4.0
2020-06	RAN#88	RP-200987	0744	1	F	CR to 38.133 on intra frequency measurements without gaps	16.4.0
2020-06	RAN#88	RP-200987	0748		A	CR on Psharingfactor_r16	16.4.0
2020-06	RAN#88	RP-200987	0750		A	CR on E-UTRAN Serving Cell Parameters_r16	16.4.0
2020-06	RAN#88	RP-200987	0752		A	CR on Modified parameters for BFD TCs with 4Rx antenna_r16	16.4.0
2020-06	RAN#88	RP-200987	0754		A	CR on BFD TCs_r16	16.4.0
2020-06	RAN#88	RP-200987	0756		A	CR on UL carrier RRC reconfiguration Delay TC_r16	16.4.0
2020-06	RAN#88	RP-200987	0758		A	CR to FR1 SCell activation delay test cases_r16	16.4.0
2020-06	RAN#88	RP-200987	0760		A	CR to inter-frequency measurement TCs_r16	16.4.0
2020-06	RAN#88	RP-200987	0762	1	F	CR to interruption TCs_r16	16.4.0

2020-06	RAN#88	RP-200987	0763	1	F	CR to FR1 SA inter-RAT measurement TCs_r16	16.4.0
2020-06	RAN#88	RP-201047	0764	1	B	CR on introduction of RRM requirements for BWP switching delay on multiple CCs	16.4.0
2020-06	RAN#88	RP-201042	0767	1	B	CR on introduction of Active TCI state switching delay with CCA Requirements for NR-U	16.4.0
2020-06	RAN#88	RP-201042	0768	2	B	CR on introduction of reporting criteria for NR-U	16.4.0
2020-06	RAN#88	RP-201042	0770	1	B	CR on introduction of RRC_INACTIVE state moblity requirements for NR-U	16.4.0
2020-06	RAN#88	RP-200987	0775		A	CR on interruption due to Acitve BWP switch (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0779		A	CR on UE transmit timing (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0781		A	Editoral CR on TS 38.133 Rel-16 (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0783		A	CR on RRC Connection Release with Redirection (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0785		A	CR on RRC Re-establishment test cases (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0787		A	CR on Timing advance test cases for EN-DC (Cat A)	16.4.0
2020-06	RAN#88	RP-200987	0789		A	CR on Timing test cases for NR SA (Cat A)	16.4.0
2020-06	RAN#88	RP-201045	0792	1	B	CR on DL interruption Tx switching between two uplink carriers	16.4.0
2020-06	RAN#88	RP-200975	0796	1	B	Cell identification in connected mode for NR-EUTRAN measurement in HST	16.4.0
2020-06	RAN#88	RP-200987	0799		A	Correction onTCI state switching R16	16.4.0
2020-06	RAN#88	RP-200987	0801		A	Accuracy of carrier aggregation in NR R16	16.4.0
2020-06	RAN#88	RP-201049	0802	1	B	Test case for NR to UTRA FDD Inter-RAT handover	16.4.0
2020-06	RAN#88	RP-200976	0804		F	CR on conditional PSCell change requirements	16.4.0
2020-06	RAN#88	RP-200973	0806	1	B	CR on SCell BFD and CBD requirements	16.4.0
2020-06	RAN#88	RP-201047	0808	1	B	CR on interruption requirements for FR2 inter-band CA	16.4.0
2020-06	RAN#88	RP-201047	0809		B	CR on scaling factor CSSFoutside_gap for FR2 inter-band CA	16.4.0
2020-06	RAN#88	RP-201047	0810	1	B	CR on scheduling availability requirements for FR2 inter-band CA	16.4.0
2020-06	RAN#88	RP-200987	0813		A	CR 38.133 (8.10.5) Corrections to RRC-based TCI state change	16.4.0
2020-06	RAN#88	RP-200966	0814		F	CR 38.133 (8.3.4-5) Corrections to Direct SCell activation	16.4.0
2020-06	RAN#88	RP-200987	0816		A	CR 38.133 (8.3.2) Corrections to SCell Activation delay requirements	16.4.0
2020-06	RAN#88	RP-200966	0817	1	F	CR 38.133 (8.3.4-5) Addition of interruption windows for Direct SCell Activation	16.4.0
2020-06	RAN#88	RP-200978	0818	1	B	CR to 38.133 for Introduction of band n259	16.4.0
2020-06	RAN#88	RP-201047	0819	1	B	CR on SCell activation requirements for FR2 inter-band CA	16.4.0
2020-06	RAN#88	RP-200987	0821		A	CR on FR2 measurement requirements outside gaps R16	16.4.0
2020-06	RAN#88	RP-200987	0823		A	CR on inter-RAT RSTD requirements for NE-DC in 38.133 R16	16.4.0
2020-06	RAN#88	RP-200987	0825		A	CR on SCell activation requirements R16	16.4.0
2020-06	RAN#88	RP-200987	0827		A	CR on SSB based L1-RSRP measurement R16	16.4.0
2020-06	RAN#88	RP-200987	0829		A	CR on L1-RSRP delay tests for FR2 R16	16.4.0
2020-06	RAN#88	RP-200987	0831		A	CR to L1-RSRP accuracy TC for FR2 EN-DC R16	16.4.0
2020-06	RAN#88	RP-200987	0833		A	CR to L1-RSRP accuracy TC for FR2 SA R16	16.4.0
2020-06	RAN#88	RP-200987	0835		A	CR to TCI state switch TC R16	16.4.0
2020-06	RAN#88	RP-200970	0836		F	CR on CLI measurement requirements	16.4.0
2020-06	RAN#88	RP-200970	0837	1	F	CR on CLI measurement performance requirements	16.4.0
2020-06	RAN#88	RP-200970	0838		B	CR on test cases for SRS-RSRP measurement accuracy in FR1	16.4.0
2020-06	RAN#88	RP-200970	0839	1	B	CR on test cases for SRS-RSRP measurement accuracy in FR2	16.4.0
2020-06	RAN#88	RP-200970	0840		B	CR on test cases for CLI-RSSI measurement accuracy in FR1	16.4.0
2020-06	RAN#88	RP-200970	0841	1	B	CR on test cases for CLI-RSSI measurement accuracy in FR2	16.4.0
2020-06	RAN#88	RP-200966	0843		B	CR on interruption requirements for direct SCell activation for 38.133	16.4.0
2020-06	RAN#88	RP-200966	0844	1	B	CR on delay requirements for SCell dormancy	16.4.0
2020-06	RAN#88	RP-200966	0845	1	B	CR on interruption requirements for SCell dormancy	16.4.0
2020-06	RAN#88	RP-201044	0847	1	B	CR for gNB Rx-Tx time difference and UL-RTOA report mapping	16.4.0
2020-06	RAN#88	RP-201044	0849	1	B	CR for AoA/ZoA report mapping	16.4.0
2020-06	RAN#88	RP-201048	0854	2	B	Measurement requirements for UEs under power saving mode	16.4.0
2020-06	RAN#88	RP-201044	0857	1	B	NR E-CID reporting criteria requirements	16.4.0
2020-06	RAN#88	RP-201044	0858	1	B	NR E-CID measurement requirements	16.4.0
2020-06	RAN#88	RP-201044	0862	1	B	Positioning measurement accuracy requirements structure in section 10	16.4.0
2020-06	RAN#88	RP-201044	0863	2	B	Reporting criteria for NR RSTD	16.4.0
2020-06	RAN#88	RP-200987	0867		A	Clarification on RLM	16.4.0
2020-06	RAN#88	RP-201042	0869		B	BWP switching interruption requirement due to consistent UL failure in 38.133	16.4.0
2020-06	RAN#88	RP-200969	0871	1	B	Applicability of 2-step RA and 4-step RA in RRM requirements in 38.133	16.4.0
2020-06	RAN#88	RP-200975	0874	1	B	CR to TS 38.133: NR HST beam management requirements	16.4.0
2020-06	RAN#88	RP-201047	0875	1	B	CR on 38133 interruption requirements for BWP switching on multiple CCs	16.4.0
2020-06	RAN#88	RP-200966	0879	1	B	Big CR Introduction of UE requirement for MR-DC early measurement reporting in 38.133	16.4.0
2020-06	RAN#88	RP-201042	0885		B	RRC release with redirection requirements in NR-U in 38.133	16.4.0
2020-06	RAN#88	RP-200988	0886	1	A	Rapportuer CR for TS38.133	16.4.0
2020-06	RAN#88	RP-201047	0887		B	CR: mandatory gap pattern	16.4.0
2020-09	RAN#88	RP-201512	0889		A	CR to Redirection from NR in FR1 to E-UTRAN	16.5.0

2020-09	RAN#88	RP-201512	0891		A	CR to timing advance adjustment accuracy in FR1	16.5.0
2020-09	RAN#88	RP-201512	0895		A	CR to SS-RSRQ Intra-Frequency and Inter-frequency FR1 measurement accuracy	16.5.0
2020-09	RAN#88	RP-201512	0897		A	Update to FR2 240kHz SSB Configurations	16.5.0
2020-09	RAN#88	RP-201512	0899		A	Update of FR2 Random Access Test cases	16.5.0
2020-09	RAN#88	RP-201512	0901		A	Update to FR2 event-triggered reporting RRM Test cases in A.5.6 and A.7.6	16.5.0
2020-09	RAN#88	RP-201512	0903		A	Update to FR2 SS-RSRP RRM Test cases in A.5.7 and A.7.7	16.5.0
2020-09	RAN#88	RP-201512	0905		A	CR to EN-DC timing advance adjustment accuracy in FR2	16.5.0
2020-09	RAN#88	RP-201512	0907		A	CR to configuration of CSI-RS for tracking	16.5.0
2020-09	RAN#88	RP-201512	0909		A	Update of RRC-based Active BWP Switch test cases	16.5.0
2020-09	RAN#88	RP-201512	0911		A	Update to FR2 Annex B RRM side conditions	16.5.0
2020-09	RAN#88	RP-201512	0913		A	Add UE Beam assumption for RRM Test cases in A.5.5	16.5.0
2020-09	RAN#88	RP-201496	0914	1	B	Introduction of the P-MPR 2 bits report mapping in 38.133	16.5.0
2020-09	RAN#88	RP-201512	0922		A	Add UE Beam assumption for RRM Test cases in A.7.5 Rel-16	16.5.0
2020-09	RAN#88	RP-201489	0924	1	F	Maintenance CR for 2-step RA	16.5.0
2020-09	RAN#88	RP-201491	0925	2	B	CR to TS 38.133: PRS RSTD requirements	16.5.0
2020-09	RAN#88	RP-201498	0928	1	F	CR on capabilities for support of event triggering and reporting criteria	16.5.0
2020-09	RAN#88	RP-201512	0931		F	CR for TS38.133 Rel-16, Corrction for SCell activation delay requirement	16.5.0
2020-09	RAN#88	RP-201512	0933		A	CR for TS38.133 Rel-16, Correction for RRM core requirements	16.5.0
2020-09	RAN#88	RP-201512	0935		A	CR for TS38.133 Rel-16, Correction for test cases of BWP switching	16.5.0
2020-09	RAN#88	RP-201498	0937	1	B	CR on CSI-RS based intra-frequency measurement requirement (Introduction, requirement applicability and number of cell and beams)	16.5.0
2020-09	RAN#88	RP-201500	0939	1	B	CR on uplink spatial relation switch delay (section 8.12)	16.5.0
2020-09	RAN#88	RP-201506	0940	1	B	Introduction of SCell activation/deactivation delay requirements for SCells operating with CCA	16.5.0
2020-09	RAN#88	RP-201491	0941	2	B	Revision of CSSF within gap to include NR positioning measurements with gap sharing	16.5.0
2020-09	RAN#88	RP-201491	0942	3	B	Introduction of new MG patterns for NR positioning	16.5.0
2020-09	RAN#88	RP-201491	0943	2	B	Introduction of UE Rx-Tx time difference measurement requirements for NR positioning	16.5.0
2020-09	RAN#88	RP-201512	0946		A	CR on TS38.133 for handover test cases	16.5.0
2020-09	RAN#88	RP-201512	0948		A	CR on TS38.133 for introducing the PDSCH RMC configuration in cell re-selection test cases	16.5.0
2020-09	RAN#88	RP-201493	0950	2	F	CR on TS38.133 for dual active protocol stack handover (Section 6.1.3)	16.5.0
2020-09	RAN#88	RP-201507	0952		F	CR on TS38.133 for intra-frequency measurement definition (Section 9.2.1)	16.5.0
2020-09	RAN#88	RP-201512	0956		A	CR on FR2 measurement capability for R16	16.5.0
2020-09	RAN#88	RP-201506	0957		B	CR on UE measurement capability of NR-U for R16	16.5.0
2020-09	RAN#88	RP-201507	0958	1	B	CR on RRM requirement based on dual DRX for FR1+FR2 CA	16.5.0
2020-09	RAN#88	RP-201506	0959		F	Update NR Frequency Band Groups to include Band n30	16.5.0
2020-09	RAN#88	RP-201506	0960		F	Update NR Frequency Band Groups to include Band n14	16.5.0
2020-09	RAN#88	RP-201506	0961		F	CR for Table number mismatch for CLI performance tests	16.5.0
2020-09	RAN#88	RP-201512	0963		A	CR on Inter-RAT RSTD measurements (section 9.4.4)	16.5.0
2020-09	RAN#88	RP-201512	0965		A	CR on active BWP switch in R16	16.5.0
2020-09	RAN#88	RP-201500	0968	1	F	CR on multiple SCells activation (section 8.3.7)	16.5.0
2020-09	RAN#88	RP-201496	0969	1	F	CR on MRTD and MTTD for FR2 inter-band CA	16.5.0
2020-09	RAN#88	RP-201498	0970	1	B	CR on MRTD for FR2 inter-band CA	16.5.0
2020-09	RAN#88	RP-201498	0971	1	B	38.133 CR on UE measurement capability on the number of frequency layers to be monitored for CSI-RS measurement	16.5.0
2020-09	RAN#88	RP-201497	0972		F	38.133 CR on cell re-selection requirements for Rel-16 NR HST	16.5.0
2020-09	RAN#88	RP-201492	0973	1	F	CR of missed requirements based on the agreed CRs in RAN4#95-e	16.5.0
2020-09	RAN#88	RP-201492	0974	1	F	CR of interruption requirements	16.5.0
2020-09	RAN#88	RP-201500	0976	1	F	CR on definition of inter-frequency measurements without measurement gap (9.3.1)	16.5.0
2020-09	RAN#88	RP-201500	0984		F	CR on BWP switch on multiple CCs	16.5.0
2020-09	RAN#88	RP-201512	0986		A	CR for SCell activation delay in FR2 in R16	16.5.0
2020-09	RAN#88	RP-201512	0988		A	CR on TCI state switch delay in R16	16.5.0
2020-09	RAN#88	RP-201506	0991	1	B	CR for timing requirement for NR-U	16.5.0
2020-09	RAN#88	RP-201488	0992	1	B	CR for introduction of pathloss reference signal switching delay	16.5.0
2020-09	RAN#88	RP-201488	0993	1	F	CR for L1-SINR requirement	16.5.0
2020-09	RAN#88	RP-201498	0996	2	B	CR on introduction, applicability and capability for CSI-RS inter-frequency measurement requirements	16.5.0
2020-09	RAN#88	RP-201500	0999	1	B	Impact of CGI reading on L1 and L3 measurement	16.5.0
2020-09	RAN#88	RP-201498	1003	1	B	38.133 CR on introduction of CSI-RS based measurement	16.5.0
2020-09	RAN#88	RP-201488	1006		F	Correction of L1-SINR reporting requirements	16.5.0
2020-09	RAN#88	RP-201506	1007	2	B	CR: Beam management requirements with CCA	16.5.0
2020-09	RAN#88	RP-201507	1008		F	[CR] Corrections to DAPS Handover	16.5.0

2020-09	RAN#88	RP-201500	1010	2	F	CR for FR2 inter-band CA requirements	16.5.0
2020-09	RAN#88	RP-201506	1011	1	D	CR to TS 38.133 - Handover requirements in NR-U	16.5.0
2020-09	RAN#88	RP-201506	1012	2	B	CR to TS 38.133 to address NR-U inter-frequency measurements	16.5.0
2020-09	RAN#88	RP-201512	1015	1	F	CR 38.133 (8.3.2-3) Corrections to SCell activation delay requirements	16.5.0
2020-09	RAN#88	RP-201494	1016	1	B	CR 38.133 (8.3.9-8.3.11) Direct SCell activation delay for multiple downlink SCells	16.5.0
2020-09	RAN#88	RP-201494	1017	2	F	CR 38.133 SCell dormancy switching of multiple SCells	16.5.0
2020-09	RAN#88	RP-201494	1018		B	CR on delay requirements for SCell dormancy	16.5.0
2020-09	RAN#88	RP-201498	1020	1	B	CR on inter-frequency CSI-RS L3 measurement requirements	16.5.0
2020-09	RAN#88	RP-201512	1023		A	Clarification of SNR values in RLM Test cases	16.5.0
2020-09	RAN#88	RP-201512	1025		A	CR to TS 38.133: Corrections to CSI-RS configurations in A.3.14 (Rel-16)	16.5.0
2020-09	RAN#88	RP-201512	1027		A	CR to TS 38.133: Corrections to event triggered test cases (Rel-16)	16.5.0
2020-09	RAN#88	RP-201512	1029		A	CR to TS 38.133: Corrections to inter-RAT test cases (Rel-16)	16.5.0
2020-09	RAN#88	RP-201512	1031		A	CR to TS 38.133: Corrections to AoA setup information in some test cases (Rel-16)	16.5.0
2020-09	RAN#88	RP-201512	1033		A	CR on maintaining handover tests in Rel-16	16.5.0
2020-09	RAN#88	RP-201500	1039	1	F	CR on maintaining measurement restriction requirements for NR CA	16.5.0
2020-09	RAN#88	RP-201500	1041	3	F	CR on BWP switching delay on mulitple CCs	16.5.0
2020-09	RAN#88	RP-201506	1042	2	F	CR on active TCI state switching for NR-U	16.5.0
2020-09	RAN#88	RP-201506	1043	2	B	CR on introduction of intra-frequency measurements requirements for NR-U	16.5.0
2020-09	RAN#88	RP-201506	1044	1	B	CR on introduction of Active BWP switching delay requirements for NR-U	16.5.0
2020-09	RAN#88	RP-201506	1045	1	B	CR on introduction of RRC_IDLE state moblity requirements for NR-U	16.5.0
2020-09	RAN#88	RP-201506	1046	1	B	Discussion on RRC re-establishment for NR-U	16.5.0
2020-09	RAN#88	RP-201512	1048		A	CR on reporting criteria for EN-DC in 38.133 R15	16.5.0
2020-09	RAN#88	RP-201512	1050		A	CR on test cases for Active TCI state switch delay R15	16.5.0
2020-09	RAN#88	RP-201512	1052		A	Addition of new default configurations for RMC scheduling_r16	16.5.0
2020-09	RAN#88	RP-201512	1054		A	Correction to beam failure detection and link recovery test cases_r16	16.5.0
2020-09	RAN#88	RP-201512	1056		A	Correction to BWP switching delay test cases_r16	16.5.0
2020-09	RAN#88	RP-201512	1058		A	Correction to FR1 intra-frequency measurement with gap test cases_r16	16.5.0
2020-09	RAN#88	RP-201512	1060		A	Correction to inter-RAT HO test cases_r16	16.5.0
2020-09	RAN#88	RP-201498	1064	2	B	CR on CSI-RS based intra-frequency measurement requirements	16.5.0
2020-09	RAN#88	RP-201500	1066	1	F	Correction on the interruption requirements due to SRS carrier switching	16.5.0
2020-09	RAN#88	RP-201500	1067	1	F	CSSF for inter-frequency measurement without gap in FR2 inter-band CA sceneario	16.5.0
2020-09	RAN#88	RP-201512	1070		A	CR on correction to CSSF within gap R16	16.5.0
2020-09	RAN#88	RP-201512	1072		A	CR on SCell activation requirements R16	16.5.0
2020-09	RAN#88	RP-201512	1075		A	CR on UL BWP configuration for RRM test cases R16	16.5.0
2020-09	RAN#88	RP-201512	1077		A	CR to add UE beam assumption for TC in A.5.6 R16	16.5.0
2020-09	RAN#88	RP-201506	1078		F	CR on reporting criteria for CLI	16.5.0
2020-09	RAN#88	RP-201494	1080	1	B	CR on direct SCell activation	16.5.0
2020-09	RAN#88	RP-201494	1081	2	F	CR on requirements for SCell dormancy	16.5.0
2020-09	RAN#88	RP-201491	1082	1	B	CR for general applicability of PRS measurement requirements	16.5.0
2020-09	RAN#88	RP-201491	1083	2	B	CR for measurement requirements for PRS-RSRP	16.5.0
2020-09	RAN#88	RP-201491	1085	2	B	CR to add CSI-RS related reporting criteria for ECID	16.5.0
2020-09	RAN#88	RP-201490	1088	2	F	Correction CR to Rel-16 UE power saving requirements	16.5.0
2020-09	RAN#88	RP-201506	1090		F	Correction to RACH delay in RRC release requirements in NR-U in 38.133	16.5.0
2020-09	RAN#88	RP-201512	1097		A	CR to 38.133 correction to RRC based BWP switch delay requirements	16.5.0
2020-09	RAN#88	RP-201512	1099		A	CR to 38.133 correction to interruption requirements for per-FR gap in FR2	16.5.0
2020-09	RAN#88	RP-201500	1100		B	CR to 38.133 on CGI reading of NR cell	16.5.0
2020-09	RAN#88	RP-201497	1101		F	CR to TS 38.133: Corrections to Table 9.4.3.3-2 in subclause 9.4.3.3 (Requirements when DRX is used)	16.5.0
2020-09	RAN#88	RP-201506	1102	2	B	Introduction of RLM requirements for NR-U	16.5.0
2020-09	RAN#88	RP-201491	1103	2	B	Measurement report mapping and additional path reporting for UE Rx-Tx	16.5.0
2020-09	RAN#88	RP-201491	1104	2	B	Measurement report mapping and additional path reporting for RSTD	16.5.0
2020-09	RAN#88	RP-201491	1106	1	F	Reporting criteria for NR positioning measurements	16.5.0
2020-09	RAN#88	RP-201491	1107		F	General introduction of NR positioning measurements	16.5.0
2020-09	RAN#88	RP-201498	1108	1	B	CR on scheduling restriction for CSI-RS based intra-frequency measurement	16.5.0

2020-09	RAN#88	RP-201507	1111		F	[CR] Replacing x in references with correct numbers (Core R16 Cat F)	16.5.0
2020-09	RAN#88	RP-201512	1113		A	[CR] Replacing x in references with correct numbers (Core R16 Cat A)	16.5.0
2020-09	RAN#88	RP-201512	1114		A	[CR] Replacing x in references with correct numbers (Perf R16 Cat A)	16.5.0
2020-09	RAN#88	RP-201512	1116		A	Fine/rough beam assumption for idle mode and measurement procedure test case	16.5.0
2020-09	RAN#88	RP-201512	1117		A	CR on BWP switching delay requirements R16	16.5.0
2020-12	RAN#90	RP-202433	1108	4	B	CR on scheduling restriction for CSI-RS based intra-frequency measurement	16.6.0
2020-12	RAN#90	RP-202487	1119		A	RB allocation and Noc level in RLM Test cases	16.6.0
2020-12	RAN#90	RP-202487	1121		A	Update FR2 event-triggered reporting Test cases in A.5.6, A.7.6	16.6.0
2020-12	RAN#90	RP-202487	1123		A	240kHz SSB SCS Configuration for FR2 SS-RSRP Test cases	16.6.0
2020-12	RAN#90	RP-202487	1125		A	Correct UE beam assumption for Test Cases in A.5.6	16.6.0
2020-12	RAN#90	RP-202487	1127		A	Aggregation level of CORESET for RMC scheduling	16.6.0
2020-12	RAN#90	RP-202487	1129		A	Claify FR1 NSA SS-SINR measurement TCs	16.6.0
2020-12	RAN#90	RP-202487	1131		A	FR1 Inter-frequency Event triggered Reporting tests in DRX	16.6.0
2020-12	RAN#90	RP-202487	1133		A	E-UTRAN	16.6.0
2020-12	RAN#90	RP-202419	1138		F	CR for DAPS HO test applicability	16.6.0
2020-12	RAN#90	RP-202487	1139		F	Maintenance CR on SA inter-frequency event triggered reporting tests for FR1	16.6.0
2020-12	RAN#90	RP-202433	1140	1	F	CR on CSSF with both CSI-RS and SSB	16.6.0
2020-12	RAN#90	RP-202444	1146		A	CR on CSI-RS BW condition for BFD/CBD R16	16.6.0
2020-12	RAN#90	RP-202444	1148		A	CR on AP-CSI-RS based L1-RSRP measurement R16	16.6.0
2020-12	RAN#90	RP-202427	1152	1	F	CR of NR V2X operating band group	16.6.0
2020-12	RAN#90	RP-202436	1155	1	F	CR on TS38.133 for dual active protocol stack handover	16.6.0
2020-12	RAN#90	RP-202430	1156	2	F	CR on TS38.133 interruption time for CA with non-aligned frame boundaries	16.6.0
2020-12	RAN#90	RP-202444	1158		F	CR on TS38.133 for inter-frequency measurement requirement without gap	16.6.0
2020-12	RAN#90	RP-202487	1160		A	CR on TS38.133 for cell activation and deactivation test case	16.6.0
2020-12	RAN#90	RP-202487	1162		A	CR on TS38.133 for cell reselection test case	16.6.0
2020-12	RAN#90	RP-202487	1164		A	CR on TS38.133 for active BWP switch test cases	16.6.0
2020-12	RAN#90	RP-202487	1165		F	CR on TS38.133 for E-UTRAN	16.6.0
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