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Foreword

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The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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- x the first digit:
 - 1 presented to TSG for information;
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document establishes the minimum RF characteristics and minimum performance requirements for E-UTRA User Equipment (UE).

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*.
 - 3GPP TR 21.905: "Vocabulary for 3GPP Specifications". [1] [2] ITU-R Recommendation SM.329-10, "Unwanted emissions in the spurious domain" ITU-R Recommendation M.1545: "Measurement uncertainty as it applies to test limits for the [3] terrestrial component of International Mobile Telecommunications-2000". [4] 3GPP TS 36.211: "Physical Channels and Modulation". 3GPP TS 36.212: "Multiplexing and channel coding". [5] [6] 3GPP TS 36.213: "Physical layer procedures". 3GPP TS 36.331: "Requirements for support of radio resource management ". [7] 3GPP TS 36.307: "Requirements on User Equipments (UEs) supporting a release-independent [8] frequency band". [9] 3GPP TS 36.423: "X2 application protocol (X2AP) ". 3GPP TS 23.303: "Technical Specification Group Services and System Aspects; Proximity-based [10] services (ProSe); Stage 2". 3GPP TS36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal [11] Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply in the case of a single component carrier. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

Aggregated Channel Bandwidth: The RF bandwidth in which a UE transmits and receives multiple contiguously aggregated carriers.

Aggregated Transmission Bandwidth Configuration: The number of resource block allocated within the aggregated channel bandwidth.

Carrier aggregation: Aggregation of two or more component carriers in order to support wider transmission bandwidths.

Carrier aggregation band: A set of one or more operating bands across which multiple carriers are aggregated with a specific set of technical requirements.

Carrier aggregation bandwidth class: A class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE.

Carrier aggregation configuration: A combination of CA operating band(s) and CA bandwidth class(es) supported by a UE.

Channel edge: The lowest and highest frequency of the carrier, separated by the channel bandwidth.

Channel bandwidth: The RF bandwidth supporting a single E-UTRA RF carrier with the transmission bandwidth configured in the uplink or downlink of a cell. The channel bandwidth is measured in MHz and is used as a reference for transmitter and receiver RF requirements.

Composite spectrum emission mask: Emission mask requirement for intraband non-contiguous carrier aggregation which is a combination of individual sub-block spectrum emissions masks.

Composite spurious emission requirement: Spurious emission requirement for intraband non-contiguous carrier aggregation which is a combination of individual sub-block spurious emission requirements.

Contiguous carriers: A set of two or more carriers configured in a spectrum block where there are no RF requirements based on co-existence for un-coordinated operation within the spectrum block.

Contiguous resource allocation: A resource allocation of consecutive resource blocks within one carrier or across contiguously aggregated carriers. The gap between contiguously aggregated carriers due to the nominal channel spacing is allowed.

Contiguous spectrum: Spectrum consisting of a contiguous block of spectrum with no sub-block gaps.

Enhanced downlink control channel performance requirements type A: This defines performance requirements for downlink control channel assuming as baseline receiver reference symbol based linear minimum mean square error interference rejection combining plus CRS interference cancellation.

Enhanced downlink control channel performance requirements type B: This defines performance requirements for downlink control channel assuming as baseline receiver reference symbol based enhanced linear minimum mean square error interference rejection combining plus CRS interference cancellation.

Enhanced performance requirements type A: This defines performance requirements assuming as baseline receiver reference symbol based linear minimum mean square error interference rejection combining.

Enhanced performance requirements type B: This defines performance requirements assuming as baseline receiver using network assisted interference cancelation and suppression.

Enhanced performance requirements type C: This defines performance requirements assuming as baseline receiver inter-stream interference cancellation.

Inter-band carrier aggregation: Carrier aggregation of component carriers in different operating bands.

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

Intra-band contiguous carrier aggregation: Contiguous carriers aggregated in the same operating band.

Intra-band non-contiguous carrier aggregation: Non-contiguous carriers aggregated in the same operating band.

Lower sub-block **edge:** The frequency at the lower edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

Category NB1 stand-alone operation: a category NB1 is operating standalone when it utilizes its own spectrum, for example the spectrum used by GERAN systems as a replacement of one or more GSM carriers, as well as scattered spectrum for potential IoT deployment.

Category NB1 guard band operation: category NB1 is operating in guard band when it utilizes the unused resource block(s) within a E-UTRA carrier's guard-band.

Category NB1 in-band operation: category NB1 is operating in-band when it utilizes the resource block(s) within a normal E-UTRA carrier.

Non-contiguous spectrum: Spectrum consisting of two or more sub-blocks separated by sub-block gap(s).

ProSe-enabled UE: A UE that supports ProSe requirements and associated procedures.

NOTE: As defined in TS 23.303 [10].

ProSe Direct Communication: A communication between two or more UEs in proximity that are ProSe-enabled.

NOTE: As defined in TS 23.303 [10].

ProSe Direct Discovery: A procedure employed by a ProSe-enabled UE to discover other ProSe-enabled UEs in its vicinity.

NOTE: As defined in TS 23.303 [10].

Sub-block: This is one contiguous allocated block of spectrum for transmission and reception by the same UE. There may be multiple instances of sub-blocks within an RF bandwidth.

Sub-block bandwidth: The bandwidth of one sub-block.

Sub-block gap: A frequency gap between two consecutive sub-blocks within an RF bandwidth, where the RF requirements in the gap are based on co-existence for un-coordinated operation.

Synchronized operation: Operation of TDD in two different systems, where no simultaneous uplink and downlink occur.

Unsynchronized operation: Operation of TDD in two different systems, where the conditions for synchronized operation are not met.

Upper sub-block edge: The frequency at the upper edge of one sub-block. It is used as a frequency reference point for both transmitter and receiver requirements.

3.2 Symbols

F_{Interferer}

F_{C,block, high}

 $F_{C_agg} \\$

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

Frequency of the interferer

Frequency of the carrier centre frequency

BW_{Channel} Channel bandwidth $BW_{Channel,block} \\$ Sub-block bandwidth, expressed in MHz. $BW_{Channel,block} = F_{edge,block,high} - F_{edge,block,low}.$ Aggregated channel bandwidth, expressed in MHz. $BW_{Channel\ CA}$ Virtual guard band to facilitate transmitter (receiver) filtering above / below edge CCs. BW_{GB} Transmitted energy per RE for reference symbols during the useful part of the symbol, i.e. E_{RS} excluding the cyclic prefix, (average power normalized to the subcarrier spacing) at the eNode B transmit antenna connector \hat{E}_{ϵ} The averaged received energy per RE of the wanted signal during the useful part of the symbol, i.e. excluding the cyclic prefix, at the UE antenna connector; average power is computed within a set of REs used for the transmission of physical channels (including user specific RSs when present), divided by the number of REs within the set, and normalized to the subcarrier spacing Frequency Aggregated Transmission Bandwidth Configuration. The lowest frequency of the simultaneously $F_{agg_alloc_low}$ transmitted resource blocks. Aggregated Transmission Bandwidth Configuration. The highest frequency of the simultaneously $F_{agg_alloc_high}$ transmitted resource blocks. Frequency offset of the interferer F_{Interferer} (offset)

Aggregated Transmission Bandwidth Configuration. Center frequency of the aggregated carriers.

Center frequency of the highest transmitted/received carrier in a sub-block.

Center frequency of the lowest transmitted/received carrier in a sub-block. F_{C,block, low} The centre frequency of the *lowest carrier*, expressed in MHz. $F_{C low}$ The centre frequency of the highest carrier, expressed in MHz. F_{C high} The lowest frequency of the downlink operating band F_{DL_low} The highest frequency of the downlink operating band F_{DL_high} The lowest frequency of the uplink operating band $F_{UL low}$ F_{UL_high} The highest frequency of the uplink operating band $F_{edge,block,low}$ The lower sub-block edge, where $F_{edge,block,low} = F_{C,block,low} - F_{offset}$ The upper sub-block edge, where $F_{edge,block,high} = F_{C,block,high} + F_{offset.}$ $F_{edge,block,high}$ The lower edge of aggregated channel bandwidth, expressed in MHz. F_{edge_low} F_{edge_high} The higher edge of aggregated channel bandwidth, expressed in MHz. Frequency offset from F_{C high} to the *higher edge* or F_{C low} to the *lower edge*. F_{offset} Separation between lower edge of a sub-block and the center of the lowest component carrier Foffset,block,low within the sub-block Separation between higher edge of a sub-block and the center of the highest component carrier Foffset,block,high within the sub-block Frequency offset in MHz needed if NS 23 is used Foffset NS 23 The boundary between the E-UTRA out of band emission and spurious emission domains. F_{OOB} The power spectral density of the total input signal (power averaged over the useful part of the I_o symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the UE antenna connector, including the own-cell downlink signal I_{or} The total transmitted power spectral density of the own-cell downlink signal (power averaged over the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the eNode B transmit antenna connector \hat{I}_{or} The total received power spectral density of the own-cell downlink signal (power averaged over the useful part of the symbols within the transmission bandwidth configuration, divided by the total number of RE for this configuration and normalised to the subcarrier spacing) at the UE antenna connector The received power spectral density of the total noise and interference for a certain RE (average I_{ot} power obtained within the RE and normalized to the subcarrier spacing) as measured at the UE antenna connector L_{CRB} Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resources blocks Transmission bandwidth which represents the length of a contiguous sub-carrier allocation L_{Ctone} expressed in units of tones Cyclic prefix length N_{cp} Downlink EARFCN N_{DL} 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_{oc1} The power spectral density of a white noise source (average power per RE normalized to the

subcarrier spacing), simulating interference in non-CRS symbols in ABS subframe from cells that

are not defined in a test procedure, as measured at the UE antenna connector.

 N_{oc2} The power spectral density of a white noise source (average power per RE normalized to the

subcarrier spacing), simulating interference in CRS symbols in ABS subframe from all cells that

are not defined in a test procedure, as measured at the UE antenna connector.

 N_{oc3} The power spectral density of a white noise source (average power per RE normalised to the

subcarrier spacing), simulating interference in non-ABS subframe from cells that are not defined

in a test procedure, as measured at the UE antenna connector

 N_{oc} The power spectral density (average power per RE normalised to the subcarrier spacing) of the

summation of the received power spectral densities of the strongest interfering cells explicitly defined in a test procedure plus N_{oc} , as measured at the UE antenna connector. The respective

power spectral density of each interfering cell relative to $\,N_{oc}\,$ ' is defined by its associated DIP

value, or the respective power spectral density of each interfering cell relative to N_{oc} is defined by

its associated Es/Noc value.

 $N_{Offs\text{-}DL}$ Offset used for calculating downlink EARFCN $N_{Offs\text{-}UL}$ Offset used for calculating uplink EARFCN

 N_{ot} The power spectral density of a white noise source (average power per RE normalised to the

subcarrier spacing) simulating eNode B transmitter impairments as measured at the eNode B

transmit antenna connector

N_{RB} Transmission bandwidth configuration, expressed in units of resource blocks

N_{RB_agg} The number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth.

N_{RB_alloc} Total number of simultaneously transmitted resource blocks in Channel bandwidth or Aggregated

Channel Bandwidth.

 $N_{RB,c}$ The transmission bandwidth configuration of component carrier c, expressed in units of resource

blocks

N_{RB,largest BW} The largest transmission bandwidth configuration of the component carriers in the bandwidth

combination, expressed in units of resource blocks

N_{RX} Number of receiver antennas

N_{tone} Transmission bandwidth configuration for category NB1, expressed in units of tones.

N_{tone 3.75kHz} Transmission bandwidth configuration for category NB1 with 3.75 kHz sub-carrier spacing,

expressed in units of tones.

N_{tone 15kHz} Transmission bandwidth configuration for category NB1 with 15 kHz sub-carrier spacing,

expressed in units of tones.

Nul. Uplink EARFCN.

 $\begin{array}{ll} Rav & Minimum \ average \ throughput \ per \ RB. \\ P_{CMAX} & The \ configured \ maximum \ UE \ output \ power. \end{array}$

 $P_{CMAX, c}$ The configured maximum UE output power for serving cell c.

 P_{EMAX} Maximum allowed UE output power signalled by higher layers. Same as IE *P-Max*, defined in [7]. $P_{EMAX, c}$ Maximum allowed UE output power signalled by higher layers for serving cell c. Same as IE

P-Max, defined in [7].

P_{Interferer} Modulated mean power of the interferer

 $\begin{array}{ll} P_{PowerClass} & P_{PowerClass} \ is \ the \ nominal \ UE \ power \ (i.e., \ no \ tolerance). \\ P_{UMAX} & The \ measured \ configured \ maximum \ UE \ output \ power. \end{array}$

Puw Power of an unwanted DL signal Pw Power of a wanted DL signal

RB_{start} Indicates the lowest RB index of transmitted resource blocks. RB_{end} Indicates the highest RB index of transmitted resource blocks.

 Δf_{OOB} Δ Frequency of Out Of Band emission.

 $\Delta R_{IB,c}$ Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving

cell c.

 $\Delta R_{IB.4R}$ Reference sensitivity adjustment due to support for 4 antenna ports.

ΔT_{IB,c} Allowed maximum configured output power relaxation due to support for inter-band CA

operation, for serving cell c.

 $\Delta T_{\rm C}$ Allowed operating band edge transmission power relaxation.

 $\Delta T_{C,c}$ Allowed operating band edge transmission power relaxation for serving cell c.

ΔT_{ProSe} Allowed operating band transmission power relaxation due to support of E-UTRA ProSe on an

operating band.

 ρ_A According to Clause 5.2 in TS 36.213 [6] ρ_B According to Clause 5.2 in TS 36.213 [6]

σ Test specific auxiliary variable used for the purpose of downlink power allocation, defined in

Annex C.3.2.

W_{gap} Sub-block gap size

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] 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 [1].

ABS Almost Blank Subframe

ACLR Adjacent Channel Leakage Ratio
ACS Adjacent Channel Selectivity

A-MPR Additional Maximum Power Reduction

AWGN Additive White Gaussian Noise

BS Base Station
CA Carrier Aggregation

CA_X Intra-band contiguous CA of component carriers in one sub-block within Band X where X is the

applicable E-UTRA operating band

CA_X-X Intra-band non-contiguous CA of component carriers in two sub-blocks within Band X where X is

the applicable E-UTRA operating band

CA_X-Y Inter-band CA of component carrier(s) in one sub-block within Band X and component carrier(s)

in one sub-block within Band Y where X and Y are the applicable E-UTRA operating band

CA_X-X-Y CA of component carriers in two sub-blocks within Band X and component carrier(s) in one sub-

block within Band Y where X and Y are the applicable E-UTRA operating bands

CC Component Carriers CG Carrier Group

CPE Customer Premise Equipment

CPE_X Customer Premise Equipment for E-UTRA operating band X

CW Continuous Wave DC Dual Connectivity

DC_X-Y Inter-band DC of component carrier(s) in one sub-block within Band X and component carrier(s)

in one sub-block within Band Y where X and Y are the applicable E-UTRA operating band

DL Downlink

DIP Dominant Interferer Proportion

EARFCN E-UTRA Absolute Radio Frequency Channel Number

EPRE Energy Per Resource Element

E-UTRA Evolved UMTS Terrestrial Radio Access

EUTRAN Evolved UMTS Terrestrial Radio Access Network

EVM Error Vector Magnitude
FDD Frequency Division Duplex
FRC Fixed Reference Channel
HD-FDD Half- Duplex FDD

MCS Modulation and Coding Scheme

MCG Master Cell Group
MOP Maximum Output Power
MPR Maximum Power Reduction
MSD Maximum Sensitivity Degradation
OCNG OFDMA Channel Noise Generator

OFDMA Orthogonal Frequency Division Multiple Access

OOB Out-of-band PA Power Amplifier

PCC Primary Component Carrier

P-MPR Power Management Maximum Power Reduction

ProSe Proximity-based Services

PSBCH Physical Sidelink Broadcast CHannel
PSCCH Physical Sidelink Control CHannel
PSDCH Physical Sidelink Discovery CHannel
PSS Primary Synchronization Signal

PSS_RA PSS-to-RS EPRE ratio for the channel PSS

PSSCH Physical Sidelink Shared CHannel PSSS Primary Sidelink Synchronization Signal

RE Resource Element

REFSENS Reference Sensitivity power level

r.m.s Root Mean Square

SCC Secondary Component Carrier

SCG Secondary Cell Group

SINR Signal-to-Interference-and-Noise Ratio

SNR Signal-to-Noise Ratio

SSS Secondary Synchronization Signal

SSS_RA SSS-to-RS EPRE ratio for the channel SSSSSS Secondary Sidelink Synchronization Signal

TDD Time Division Duplex UE User Equipment

UL Uplink

UL-MIMO Up Link Multiple Antenna transmission
UMTS Universal Mobile Telecommunications System

UTRA UMTS Terrestrial Radio Access

UTRAN UMTS Terrestrial Radio Access Network

xCH_RA xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols not containing cell-

specific RS

xCH_RB xCH-to-RS EPRE ratio for the channel xCH in all transmitted OFDM symbols containing cell-

specific RS

4 General

4.1 Relationship between minimum requirements and test requirements

The Minimum Requirements given in this specification make no allowance for measurement uncertainty. The test specification TS 36.521-1 Annex F defines Test Tolerances. These Test Tolerances are individually calculated for each test. The Test Tolerances are used to relax the Minimum Requirements in this specification to create Test Requirements.

The measurement results returned by the Test System are compared - without any modification - against the Test Requirements as defined by the shared risk principle.

The Shared Risk principle is defined in ITU-R M.1545 [3].

4.2 Applicability of minimum requirements

- a) In this specification the Minimum Requirements are specified as general requirements and additional requirements. Where the Requirement is specified as a general requirement, the requirement is mandated to be met in all scenarios
- b) For specific scenarios for which an additional requirement is specified, in addition to meeting the general requirement, the UE is mandated to meet the additional requirements.
- c) The reference sensitivity power levels defined in subclause 7.3 are valid for the specified reference measurement channels.
- d) NOTE: Receiver sensitivity degradation may occur when:
 - 1) The UE simultaneously transmits and receives with bandwidth allocations less than the transmission bandwidth configuration (see Figure 5.6-1), and
 - 2) Any part of the downlink transmission bandwidth is within an uplink transmission bandwidth from the downlink center subcarrier.
- e) The spurious emissions power requirements are for the long term average of the power. For the purpose of reducing measurement uncertainty it is acceptable to average the measured power over a period of time sufficient to reduce the uncertainty due to the statistical nature of the signal.
- f) The requirements in this specification for TDD operating bands apply for downlink and uplink operations using Frame Structure Type 2 [4] except for Band 46 operating with Frame Structure Type 3.

33

4.3 Void

4.3A Applicability of minimum requirements (CA, UL-MIMO, ProSe, Dual Connectivity, UE category 0, UE category M1, UE category NB1)

The requirements in clauses 5, 6 and 7 which are specific to CA, UL-MIMO, ProSe, Dual Connectivity, UE category 0, UE category M1, and UE category NB1 are specified as suffix A, B, C, D, E, and F where;

- a) Suffix A additional requirements need to support CA
- b) Suffix B additional requirements need to support UL-MIMO
- c) Suffix C additional requirements need to support Dual Connectivity
- d) Suffix D additional requirements need to support ProSe
- e) Suffix E additional requirements need to support UE category 0 and category M1
- f) Suffix F additional requirements need to support UE category NB1

A terminal which supports the above features needs to meet both the general requirements and the additional requirement applicable to the additional subclause (suffix A, B, C, D, E and F) in clauses 5, 6 and 7. Where there is a difference in requirement between the general requirements and the additional subclause requirements (suffix A, B, C, D, E and F) in clauses 5, 6 and 7, the tighter requirements are applicable unless stated otherwise in the additional subclause.

A terminal which supports more than one feature (CA, UL-MIMO, ProSe, Dual Connectivity, UE category 0, UE category M1 and UE category NB1) in clauses 5, 6 and 7 shall meet all of the separate corresponding requirements.

For a terminal supporting CA, compliance with minimum requirements for non-contiguous intra-band carrier aggregation in any given operating band does not imply compliance with minimum requirements for contiguous intra-band carrier aggregation in the same operating band.

For a terminal supporting CA, compliance with minimum requirements for contiguous intra-band carrier aggregation in any given operating band does not imply compliance with minimum requirements for non- contiguous intra-band carrier aggregation in the same operating band.

A terminal which supports a DL CA configuration shall support all the lower order fallback DL CA combinations and it shall support at least one bandwidth combination set for each of the constituent lower order DL combinations containing all the bandwidths specified within each specific combination set of the upper order DL combination.

A terminal which supports CA, for each supported CA configuration, shall support Pcell transmissions in each of the aggregated Component Carriers unless indicated otherwise in clause 5.6A.1.

Terminal supporting Dual Connectivity configuration shall meet the minimum requirements for corresponding CA configuration (suffix A), unless otherwise specified.

For a terminal that supports ProSe Direct Communication and/or ProSe Direct Discovery, the minimum requirements are applicable when

- the UE is associated with a serving cell on the ProSe carrier, or
- the UE is not associated with a serving cell on the ProSe carrier and is provisioned with the preconfigured radio parameters for ProSe Direct Communications and/or ProSe Direct Discovery that are associated with known Geographical Area, or
- the UE is associated with a serving cell on a carrier different than the ProSe carrier, and the radio parameters for ProSe Direct Discovery on the ProSe carrier are provided by the serving cell, or

- the UE is associated with a serving cell on a carrier different than the ProSe carrier, and has a non-serving cell selected on the ProSe carrier that supports ProSe Direct Discovery and/or ProSe Direct Communication.

When the ProSe UE is not associated with a serving cell on the ProSe carrier, and the UE does not have knowledge of its geographical area, or is provisioned with preconfigured radio parameters that are not associated with any Geographical Area, ProSe transmissions are not allowed, and the requirements in Section 6.3.3D apply.

A terminal that supports simultaneous E-UTRA ProSe sidelink transmissions and E-UTRA uplink transmissions for the inter-band E-UTRA ProSe/E-UTRA bands specified in Table 5.5D-2, shall meet the minimum requirements for the corresponding inter-band UL CA configuration (suffix A), unless otherwise specified. For transmitter characteristics specified in clause 6, the terminal is required to meet the conformance tests for the corresponding inter-band UL CA configuration and is not required to be retested with simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions.

4.4 RF requirements in later releases

The standardisation of new frequency bands and carrier aggregation configurations (downlink and uplink aggregation) may be independent of a release. However, in order to implement a UE that conforms to a particular release but supports a band of operation or a carrier aggregation configuration that is specified in a later release, it is necessary to specify some extra requirements. TS 36.307 [8] specifies requirements on UEs supporting a frequency band or a carrier aggregation configuration that is independent of release.

NOTE: For UEs conforming to the 3GPP release of the present document, some RF requirements of later releases may be mandatory independent of whether the UE supports the bands specif or carrier aggregation configurations ied in later releases or not. The set of RF requirements of later releases that is also mandatory for UEs conforming to the 3GPP release of the present document is determined by regional regulation.

5 Operating bands and channel arrangement

5.1 General

The channel arrangements presented in this clause are based on the operating bands and channel bandwidths defined in the present release of specifications.

NOTE: Other operating bands and channel bandwidths may be considered in future releases.

- 5.2 Void
- 5.3 Void
- 5.4 Void

5.5 Operating bands

E-UTRA is designed to operate in the operating bands defined in Table 5.5-1.

Table 5.5-1 E-UTRA operating bands

E-UTRA Operating Band	Uplink (UL) ope BS reco UE tran	eive	Downlink (DL) operating band BS transmit UE receive FDL_low - FDL_high	Duplex Mode
1	1920 MHz –	1980 MHz	2110 MHz - 2170 MHz	FDD
2	1850 MHz –	1910 MHz	1930 MHz — 1990 MHz	FDD
3	1710 MHz –	1785 MHz	1805 MHz — 1880 MHz	FDD
4	1710 MHz –	1765 MHz	2110 MHz — 2155 MHz	FDD
5	824 MHz –	849 MHz	869 MHz — 894MHz	FDD
6 ¹	830 MHz -	840 MHz		FDD
7	0500 1411	2570 MHz		FDD
8	880 MHz –	915 MHz	2620 MHz — 2690 MHz 925 MHz — 960 MHz	FDD
0	OOU IVITIZ —		923 MHZ - 900 MHZ	
9	1749.9 MHz	1784.9 MHz	1844.9 MHz ⁻ 1879.9 MHz	FDD
10	1710 MHz -	1770 MHz	2110 MHz - 2170 MHz	FDD
11	1427.9 MHz –	1447.9 MHz	1475.9 MHz — 1495.9 MHz	FDD
12	699 MHz –	716 MHz	729 MHz - 746 MHz	FDD
13	777 MHz –	787 MHz	746 MHz — 756 MHz	FDD
14	788 MHz –	798 MHz	758 MHz — 768 MHz	FDD
15	Reserv		Reserved	FDD
16	Reserv		Reserved	FDD
17	704 MHz —	716 MHz	734 MHz — 746 MHz	FDD
18	815 MHz –	830 MHz	860 MHz - 875 MHz	FDD
19	830 MHz -	845 MHz	875 MHz — 890 MHz	FDD
20	832 MHz -	862 MHz	791 MHz — 821 MHz	FDD
21	1447.9 MHz –	1462.9 MHz	1495.9 MHz — 1510.9 MHz	FDD
22	3410 MHz -	3490 MHz	3510 MHz - 3590 MHz	FDD
23	2000 MHz -	2020 MHz	2180 MHz — 2200 MHz	FDD
24	1626.5 MHz –	1660.5 MHz	1525 MHz — 1559 MHz	FDD
25	1850 MHz -	1915 MHz	1930 MHz - 1995 MHz	FDD
26		849 MHz	i	FDD
27	814 MHz — 807 MHz —	824 MHz		FDD
28		748 MHz		FDD
29	703 MHz – N/A		758 MHz — 803 MHz 717 MHz — 728 MHz	FDD ²
30	2305 MHz —	2315 MHz	2350 MHz — 2360 MHz	FDD
		457.5 MHz	•	
31 32	452.5 MHz — N/A			FDD ²
			1452 MHz — 1496 MHz	
33	1900 MHz —	1920 MHz 2025 MHz	1900 MHz — 1920 MHz	TDD
34 35	2010 MHz – 1850 MHz –	1910 MHz	2010 MHz - 2025 MHz 1850 MHz - 1910 MHz	TDD TDD
36	1930 MHz –	1990 MHz	1930 MHz — 1910 MHz	TDD
37	1910 MHz –	1930 MHz	1930 MHz — 1990 MHz	TDD
38		2620 MHz		TDD
39	2570 MHz – 1880 MHz –	1920 MHz	2570 MHz — 2620 MHz 1880 MHz — 1920 MHz	TDD
40	2300 MHz -	2400 MHz	2300 MHz — 2400 MHz	TDD
41	2496 MHz	2690 MHz	2496 MHz 2690 MHz	TDD
42		3600 MHz		TDD
43		3800 MHz	3400 MHz - 3600 MHz 3600 MHz - 3800 MHz	TDD
44	3600 MHz – 703 MHz –	803 MHz	703 MHz — 803 MHz	TDD
45	1447 MHz –	1467 MHz	1447 MHz — 1467 MHz	TDD
45 46	5150 MHz -	5925 MHz	5150 MHz - 5925 MHz	TDD ^{8,9}
	3 130 IVITZ -	OSZO IVITIZ	3130 IVII 12 - 3923 IVIDZ	וטט־יי־
64		Rese		
65	1920 MHz -	2010 MHz	2110 MHz - 2200 MHz	FDD
66	1710 MHz –	1780 MHz	2110 MHz - 2200 MHz	FDD ⁴
67	N/A		738 MHz - 758 MHz	FDD ²
68	698 MHz – Band 6 is not applicat		753 MHz - 783 MHz	FDD

NOTE 1: Band 6 is not applicable

NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured. The downlink operating band is paired with the uplink operating band (external) of the

carrier aggregation configuration that is supporting the configured Pcell.

NOTE 3: A UE that complies with the E-UTRA Band 65 minimum requirements in this specification shall also comply with the E-UTRA Band 1 minimum requirements.

NOTE 4: The range 2180-2200 MHz of the DL operating band is restricted to E-UTRA operation when carrier aggregation is configured.

NOTE 5: A UE that supports E-UTRA Band 66 shall receive in the entire DL operating band NOTE 6: A UE that supports E-UTRA Band 66 and CA operation in any CA band shall also comply with the minimum requirements specified for the DL CA configurations CA_66B, CA_66C and CA_66A-66A.

NOTE 7: A UE that complies with the E-UTRA Band 66 minimum requirements in this specification shall also comply with the E-UTRA Band 4 minimum requirements.

NOTE 8: This band is an unlicensed band restricted to licensed-assisted operation using Frame Structure Type 3

NOTE 9: In this version of the specification, restricted to E-UTRA DL operation when carrier

5.5A Operating bands for CA

aggregation is configured.

E-UTRA carrier aggregation is designed to operate in the operating bands defined in Tables 5.5A-1, 5.5A-2, 5.5A-2a, 5.5A-2b and 5.5A-3.

Table 5.5A-1: Intra-band contiguous CA operating bands

E-UTRA	E-UTRA	Uplink (UL)	ope	erating band	Downlink (D	L) o	perating band	Duplex Mode	
CA Band	Band	BS receive) / U	E transmit	BS transi	BS transmit / UE receive			
		F _{UL_low}	-	F _{UL_high}	$F_{DL_low} - F_{DL_high}$				
CA_1	1	1920 MHz	-	1980 MHz	2110 MHz	-	2170 MHz	FDD	
CA_2	2	1850 MHz	-	1910 MHz	1930 MHz	_	1990 MHz	FDD	
CA_3	3	1710MHz	-	1785MHz	1805MHz	-	1880MHz	FDD	
CA_5	5	824 MHz	-	849 MHz	869 MHz	_	894 MHz	FDD	
CA_7	7	2500 MHz	1	2570 MHz	2620 MHz	_	2690 MHz	FDD	
CA_8	8	880 MHz	-	915 MHz	925 MHz	_	960 MHz	FDD	
CA_12	12	699 MHz	-	716 MHz	729 MHz	_	746 MHz	FDD	
CA_23	23	2000 MHz	_	2020 MHz	2180 MHz	_	2200 MHz	FDD	
CA_27	27	807 MHz	-	824 MHz	852 MHz	_	869 MHz	FDD	
CA_38	38	2570 MHz	-	2620 MHz	2570 MHz	-	2620 MHz	TDD	
CA_39	39	1880 MHz	-	1920 MHz	1880 MHz	_	1920 MHz	TDD	
CA_40	40	2300 MHz	-	2400 MHz	2300 MHz	_	2400 MHz	TDD	
CA_41	41	2496 MHz	-	2690 MHz	2496 MHz	-	2690 MHz	TDD	
CA_42	42	3400 MHz	-	3600 MHz	3400 MHz	_	3600 MHz	TDD	
CA_66	66	1710 MHz	_	1780 MHz	2110 MHz	_	2200 MHz	FDD	

Table 5.5A-2: Inter-band CA operating bands (two bands)

E-UTRA		E-UTRA Uplink (UL) operating band			Downlink (D	Duplex		
CA Band	Band			UE transmit			UE receive	Mode
			w -	F _{UL_high}		w –	F _{DL_high}	
CA_1-3	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
0/(_1 0	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	100
CA_1-3-3	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-3-3	3	1710 MHz	_	1785 MHz	1805 MHz	-	1880 MHz	FDD
CA 15	1	1920 MHz	_	1980 MHz	2110 MHz	1	2170 MHz	FDD
CA_1-5	5	824 MHz	_	849 MHz	869 MHz	-	894 MHz	רטט
04.4.7	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	EDD
CA_1-7	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-8	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-11	11	1427.9 MHz	_	1447.9 MHz	1475.9 MHz	_	1495.9 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-18	18	815 MHz	_	830 MHz	860 MHz	_	875 MHz	FDD
	1	1920 MHz		1980 MHz	2110 MHz		2170 MHz	
CA_1-19	19	830 MHz		845 MHz	875 MHz	_	890 MHz	FDD
			_			_		
CA_1-20	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	
CA_1-21	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	FDD
	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	
CA_1-26	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
	26	814 MHz	_	849 MHz		_		
CA_1-28	1	1920 MHz	_	1980 MHz	2110 MHz	10 MHz - 894 MHz 10 MHz - 2170 MHz	FDD	
0/(_1/20	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	
CA_1-40	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
CA 4.44	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-41	41	2496 MHz	_	2690 MHz	2496 MHz	-	2690 MHz	TDD
0.4 4.40	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-46	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	TDD
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	2	1850 MHz	_	1910 MHz	1930 MHz		1990 MHz	
CA_2-4-4	4	1710 MHz	_	1755 MHz	2110 MHz	-	2155 MHz	FDD
	2	1850 MHz		1910 MHz	1930 MHz		1990 MHz	
CA_2-5	5	824 MHz	_	849 MHz		_	894 MHz	FDD
		+	_	1910 MHz	869 MHz	_		
CA_2-2-5	<u>2</u> 5	1850 MHz	_		1930 MHz	_	1990 MHz	FDD
		824 MHz	_	849 MHz	869 MHz	-	894 MHz	
CA_2-7	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
_	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	
CA_2-12	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
CA_2-2-	2	1850 MHz	_	1910 MHz	1930 MHz	-	1990 MHz	FDD
12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	100
CA_2-13	2	1850 MHz	_	1910 MHz	1930 MHz	ı	1990 MHz	FDD
OA_Z-13	13	777 MHz	_	787 MHz	746 MHz	1	756 MHz	טט ו
CA_2-2-	2	1850 MHz		1910 MHz	1930 MHz	-	1990 MHz	EDD
13	13	777 MHz	-	787 MHz	746 MHz	-	756 MHz	FDD
04 0 :=	2	1850 MHz	_	1910 MHz	1930 MHz	-	1990 MHz	
CA_2-17	17	704 MHz	_	716 MHz	734 MHz	_	746 MHz	FDD
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-28	28	703 MHz		748 MHz	758 MHz	_	803 MHz	FDD
	20	1850 MHz		1910 MHz	1930 MHz	_	1990 MHz	
CA_2-29	_	1000 IVII IZ	1	1010 1011 12	1 J J J IVII IZ		1000 IVII IZ	FDD

	_			1010 1411		ı	4000 1411	1
CA_2-30	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	FDD
CA_2-46	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	FDD
	46 3	5150 MHz 1710 MHz	_	5925 MHz 1785 MHz	5150 MHz 1805 MHz	_	5925 MHz 1880 MHz	TDD
CA_3-5	5	824 MHz	_			_		FDD
	3	1710 MHz	_	849 MHz 1785 MHz	869 MHz 1805 MHz	_	894 MHz 1880 MHz	
CA_3-3-5	5	824 MHz	_		869 MHz	_		FDD
	3		_	849 MHz		_	894 MHz	
CA_3-7	7	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	3	2500 MHz	_	2570 MHz 1785 MHz	2620 MHz	_	2690 MHz	
CA_3-8	8	1710 MHz	_		1805 MHz	_	1880 MHz	FDD
	3	880 MHz 1710 MHz	_	915 MHz 1785 MHz	925 MHz 1805 MHz	_	960 MHz 1880 MHz	
CA_3-3-8	8	880 MHz	_	915 MHz	925 MHz	_		FDD
	3	1710 MHz	_			_	960 MHz	
CA_3-19			_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	
CA_3-20	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	
CA_3-26	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
_	26	814 MHz	_	849 MHz	859 MHz	_	894 MHz	
CA_3-27	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	27	807 MHz	_	824 MHz	852 MHz	_	869 MHz	
CA_3-28	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	
CA_3-31	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
6 7 (<u>-</u> 6 6)	31	452.5 MHz	_	457.5 MHz	462.5 MHz	_	467.5 MHz	
CA_3-38	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
<u> </u>	38	2570 MHz	_	2620 MHz	2570 MHz	_	2620 MHz	TDD
CA_3-40	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
CA_3-41	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
CA_3-42	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
CA_3-46	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
<u> </u>	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	TDD
CA 4-5	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	100
CA_4-4-5	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
0/(_++0	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	100
CA_4-7	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
O/ (_+ /	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	100
CA_4-4-7	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
OA_+-+-1	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	100
CA_4-12	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
UA_4-12	12	699 MHz	-	716 MHz	729 MHz	_	746 MHz	100
CA_4-4-	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	100
CA_4-13	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
UA_4-13	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	FDD
CA_4-4-	4	1710 MHz	ı	1755 MHz	2110 MHz	-	2155 MHz	FDD
13	13	777 MHz	-	787 MHz	746 MHz	_	756 MHz	רטט
CA 4.17	4	1710 MHz	-	1755 MHz	2110 MHz	-	2155 MHz	EDD
CA_4-17	17	704 MHz		716 MHz	734 MHz	_	746 MHz	FDD
CA 4.07	4	1710 MHz	_	1755 MHz	2110 MHz	-	2155 MHz	EDD
CA_4-27	27	807 MHz	_	824 MHz	852 MHz	_	869 MHz	FDD
CA 4.00	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	רחח
CA_4-28	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
CA 4.00	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	EDD
CA_4-29	29		N/		717 MHz	_	728 MHz	FDD

		1		T	I			T
CA_4-4-	4	1710 MHz	_	1755 MHz	2110 MHz	-	2155 MHz	FDD
29	29		N/		717 MHz	_	728 MHz	
CA_4-30	4	1710 MHz	-	1755 MHz	2110 MHz	_	2155 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	100
CA_4-4-	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
30	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	ו טט
CA 4.40	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
CA_4-46	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	TDD
04.5.7	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
CA_5-7	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
CA_5-12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
CA_5-13	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
CA_5-17	17	704 MHz	_	716 MHz	734 MHz	_	746 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz		894 MHz	
CA_5-25	25	1850 MHz	_	1915 MHz	1930 MHz	_	1995 MHz	FDD
						_		
CA_5-29	5	824 MHz		849 MHz	869 MHz	_	894 MHz	FDD
	29	004 1411	N/		717 MHz	_	728 MHz	
CA_5-30	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
_	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
CA_5-38	5	824 MHz	-	849 MHz	869 MHz	_	894 MHz	FDD
	38	2570 MHz	_	2620 MHz	2570 MHz	_	2620 MHz	TDD
CA_5-40	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
OA_3-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
CA_7-8	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
CA_1-0	8	880 MHz	_	915 MHz	925 MHz	-	960 MHz	רטט
CA 7.40	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	רסס
CA_7-12	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
04 7 00	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	500
CA_7-20	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	
CA_7-22	22	3410 MHz	_	3490 MHz	3510 MHz	_	3590 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	
CA_7-28	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
CA_7-40	40	2300 MHz		2400 MHz	2300 MHz		2400 MHz	TDD
	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
CA_7-42	42		_	3600 MHz	3400 MHz	_		TDD
04 7 40		3400 MHz	_			_	3600 MHz	
CA_7-42-	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
CA_7-46	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	TDD
CA_8-11	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
	11	1427.9 MHz	_	1447.9 MHz	1475.9 MHz	_	1495.9 MHz	100
CA_8-20	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
OA_0-20	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	100
CA 9 40	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
CA_8-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
04 0 11	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
CA_8-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
04 5 15	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	FDD
CA_8-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	11	1427.9 MHz	_	1447.9 MHz	1475.9 MHz	_	1495.9 MHz	
CA_11-18	18	815 MHz	_	830 MHz	860 MHz	_	875 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
CA_12-25	25	1850 MHz		1915 MHz	1930 MHz	_	1995 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz		746 MHz	-
CA_12-30			_			_		FDD
	30	2305 MHz		2315 MHz	2350 MHz		2360 MHz	l .

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CA_18-28	18	815 MHz	_	830 MHz	860 MHz	_	875 MHz	FDD
0. (0 _0	28	703 MHz	_	733 MHz ¹	758 MHz	_	788 MHz ¹	
CA_19-21	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	FDD
07 (_ 10 _ 1	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	
CA_19-28	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	FDD
0/(_10 20	28	718 MHz ¹	_	748 MHz	773 MHz ¹	_	803 MHz	
CA_19-42	19	830 MHz	-	845 MHz	875 MHz	-	890 MHz	FDD
OA_13-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
CA_20-31	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
CA_20-31	31	452.5 MHz	_	457.5 MHz	462.5 MHz	_	467.5 MHz	רטט
CA_20-32	20	832 MHz	-	862 MHz	791 MHz	-	821 MHz	FDD
CA_20-32	32		N/	'A	1452 MHz	-	1496 MHz	רטט
CA 20 20	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
CA_20-38	38	2570 MHz	-	2620 MHz	2570 MHz	-	2620 MHz	TDD
CA 20 40	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
CA_20-40	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
04 00 40	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
CA_20-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
CA_20-	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	FDD
42-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
0	20	832 MHz	_	862 MHz	791 MHz	_	821 MHz	
CA_20-67	67		N/	'A	738 MHz	_	758 MHz	FDD
	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	FDD
CA_21-42	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	23	2000 MHz	_	2020 MHz	2180 MHz	_	2200 MHz	
CA_23-29	29		N/		717 MHz	_	728 MHz	FDD
	25	1850 MHz	I _	1915 MHz	1930 MHz	_	1995 MHz	
CA_25-26	26	814 MHz	_	849 MHz	859 MHz	_	894 MHz	FDD
	25	1850 MHz	_	1915 MHz	1930 MHz	_	1995 MHz	FDD
CA_25-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
	26	814 MHz	_	849 MHz	859 MHz	_	894 MHz	FDD
CA_26-41	41	2496 MHz		2690 MHz	2496 MHz	_	2690 MHz	TDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
CA_28-40	40	2300 MHz		2400 MHz	2300 MHz	_	2400 MHz	TDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
CA_28-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
	28	703 MHz	_	748 MHz	758 MHz	_	803 MHz	FDD
CA_28-42	42	3400 MHz	_	3600 MHz	3400 MHz		3600 MHz	TDD
	29	3400 WII IZ	N/		717 MHz		728 MHz	100
CA_29-30	30	2305 MHz	I _	2315 MHz	2350 MHz	_	2360 MHz	FDD
	38	2570 MHz		2620 MHz	2570 MHz		2620 MHz	
CA_38-40	40	2300 MHz		2400 MHz	2300 MHz	_	2400 MHz	TDD
	39		_	1920 MHz		_		
CA_39-41		1880 MHz	_		1880 MHz	_	1920 MHz	TDD
	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	
CA_41-42	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	
CA_41-46	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	TDD
	46	5150 MHz	_	5925 MHz	5150 MHz	_	5925 MHz	
CA_42-46	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	46	5150 MHz	_	5925 MHz	5150 MHz	<u> </u>	5925 MHz	
NOTE 1: T	ne trequency	range in band 2	28 is	s restricted for this	CA band comb	ınati	on.	

Table 5.5A-2a: Inter-band CA operating bands (three bands)

E-UTRA CA	E-UTRA	Uplink (UL) o			•		perating band	Duplex
Band	Band	BS receive					UE receive	Mode
		F _{UL_low} -				w –	F _{DL_high}	
	1	1920 MHz -		1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-5	3	1710 MHz -	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
	5	824 MHz -	_	849 MHz	869 MHz	_	894 MHz	
	1	1920 MHz -	- '	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-7	3	1710 MHz -	- l ·	1785 MHz	1805 MHz	_	1880 MHz	FDD
	7	2500 MHz -	- 2	2570 MHz	2620 MHz	_	2690 MHz	
	1	1920 MHz -	- ['	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-8	3	1710 MHz -	- ['	1785 MHz	1805 MHz	_	1880 MHz	FDD
	8	880 MHz -	- (915 MHz	925 MHz	_	960 MHz	
	1	1920 MHz -	- -	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-19	3	1710 MHz -	- -	1785 MHz	1805 MHz	_	1880 MHz	FDD
	19	830 MHz -		845 MHz	875 MHz	_	890 MHz	1
	1	1920 MHz -	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-20	3	1710 MHz -	_	1785 MHz	1805 MHz		1880 MHz	FDD
0/1_1 0 20	20	832 MHz -		862 MHz	791 MHz		821 MHz	1 00
	1	1920 MHz -		1980 MHz	2110 MHz		2170 MHz	
CA 1226	3	1710 MHz -	_	1785 MHz	1805 MHz		1880 MHz	FDD
CA_1-3-26	26				859 MHz	_	894 MHz	FDD
	1	814 MHz -		849 MHz	2110 MHz	_		
04 4 0 00		1920 MHz –	_	1980 MHz		_	2170 MHz	
CA_1-3-28	3	1710 MHz -		1785 MHz	1805 MHz	_	1880 MHz	FDD
	28	703 MHz -	_	748 MHz	758 MHz	_	803 MHz	
	1	1920 MHz -	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-3-40	3	1710 MHz -	_	1785 MHz	1805 MHz	_	1880 MHz	
	40	2300 MHz		2400 MHz	2300 MHz	_	2400 MHz	TDD
	1	1920 MHz -	- '	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-3-42	3	1710 MHz -	- '	1785 MHz	1805 MHz	_	1880 MHz	100
	42	3400 MHz -	- ;	3600 MHz	3400 MHz	_	3600 MHz	TDD
	1	1920 MHz -	- '	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-5-7	5	824 MHz -	- 8	849 MHz	869 MHz	_	894 MHz	FDD
	7	2500 MHz -	- 2	2570 MHz	2620 MHz	_	2690 MHz	
	1	1920 MHz -	- -	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-5-40	5	824 MHz -	- 8	849 MHz	869 MHz	_	894 MHz	FDD
_	40	2300 MHz -	- 2	2400 MHz	2300 MHz	_	2400 MHz	TDD
	1	1920 MHz	- -	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-7-8	7	2500 MHz -	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
0 / 1 <u>−</u> 1 1 0	8	880 MHz -		915 MHz	925 MHz	_	960 MHz	1
	1	1920 MHz -		1980 MHz	2110 MHz		2170 MHz	
CA_1-7-20	7	2500 MHz -	_	2570 MHz	2620 MHz		2690 MHz	FDD
0/(_1 / 20	20	832 MHz -	_	862 MHz	791 MHz		821 MHz	1 00
	1	1920 MHz -	_	1980 MHz	2110 MHz		2170 MHz	
CA 1720	7		_					EDD
CA_1-7-28		2500 MHz –	_	2570 MHz	2620 MHz	_	2690 MHz	FDD
	28	703 MHz —	_	748 MHz	758 MHz	_	803 MHz	
04 4 0 44	1	1920 MHz -	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-8-11	8	880 MHz –		915 MHz	925 MHz	_	960 MHz	FDD
	11	1427.9 MHz -		1447.9 MHz	1475.9 MHz	_	1495.9 MHz	
	1	1920 MHz -	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-8-40	8	880 MHz -	_	915 MHz	925 MHz	_	960 MHz	
	40	2300 MHz -		2400 MHz	2300 MHz	_	2400 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz]
CA_1-11-18	11	1427.9 MHz -	- '	1447.9 MHz	1475.9 MHz	_	1495.9 MHz	FDD
	18	815 MHz -	- [830 MHz	860 MHz	-	875 MHz	
	1	1920 MHz -	- [.	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-18-28	18	815 MHz -	- 8	830 MHz	860 MHz	_	875 MHz	FDD
	28	703 MHz -	_	733 MHz ¹	758 MHz	_	788 MHz ¹	1
CA_1-19-21	1	1920 MHz -		1980 MHz	2110 MHz	_	2170 MHz	F2.5
		· · · · -		845 MHz		 	890 MHz	FDD

	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	I _	1510.9 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
04 440 00			_			_		
CA_1-19-28	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	FDD
	28	718 MHz ¹	_	748 MHz	773 MHz ¹	_	803 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-19-42	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	
	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	FDD
CA_1-21-42	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	100
	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-5	4	1710 MHz	1	1755 MHz	2110 MHz	_	2155 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-2-4-5	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-4-5	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	1
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA 2-4-7	4	1710 MHz		1755 MHz	2110 MHz		2155 MHz	FDD
O/(_Z + /	7	2500 MHz		2570 MHz	2620 MHz		2690 MHz	100
	2	1850 MHz	=	1910 MHz	1930 MHz		1990 MHz	
CA_2-4-12	4	1710 MHz		1755 MHz	2110 MHz		2155 MHz	FDD
CA_2-4-12	12		_	716 MHz		_		רטט
	2	699 MHz	_		729 MHz	_	746 MHz	
04 0 4 40		1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-13	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	
	2	1850 MHz	-	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-29	4	1710 MHz	-	1755 MHz	2110 MHz	_	2155 MHz	FDD
	29		N/A		717 MHz	_	728 MHz	
	2	1850 MHz	-	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-30	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD
	30	2305 MHz	-	2315 MHz	2350 MHz	_	2360 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-5-12	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-2-5-12	5	824 MHz	1	849 MHz	869 MHz	-	894 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-5-13	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	13	777 MHz	_	787 MHz	746 MHz	_	756 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-5-29	5	824 MHz	_	849 MHz	869 MHz	_	894MHz	FDD
	29	-	N/A		717 MHz	_	728 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-5-30	5	824 MHz		849 MHz	869 MHz	_	894 MHz	FDD
0/1_2 0 00	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
	2	1850 MHz		1910 MHz	1930 MHz		1990 MHz	
CA_2-7-12	7 2500 MHz –	2570 MHz	2620 MHz		2690 MHz	FDD		
CA_2-1-12	12		_		1	_		- 100
		699 MHz	_	716 MHz	729 MHz	_	746 MHz	
CA 2 40 00	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-12-30	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
	2	1850 MHz	-	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-29-30	29		N//		717 MHz	_	728 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	
CA_3-5-40	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
O, (_O O ¬O	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	. 55

	ı			T			1
	40	2000 1111 12			_		TDD
	3	1710 MHz -			_		
CA_3-7-8	7	2500 MHz -			_		FDD
	8	880 MHz -			_		
	3	1710 MHz -	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-7-20	7	2500 MHz -	2570 MHz	2620 MHz	_	2690 MHz	FDD
	20	832 MHz -	862 MHz	791 MHz	_	821 MHz	
	3	1710 MHz -	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-7-28	7	2500 MHz -	- 1785 MHz	FDD			
	28	703 MHz -	748 MHz	758 MHz	_	803 MHz	
	3	1710 MHz -	1785 MHz	1805 MHz	_	1880 MHz	
CA_3-8-40	8	880 MHz -	915 MHz		_	960 MHz	FDD
_	40				_		TDD
	3	1710 MHz -			_		
CA_3-19-42	19	830 MHz -			_		FDD
0/ _0 .0	42	3400 MHz -			_		TDD
	3	1710 MHz -	+				
CA_3-7-38	7						FDD
OA_5-7-50	38						TDD
	3	1710 MHz -			_		טטו
CA 2 20 40		ł — — —	+		_		FDD
CA_3-28-40	28	703 MHz –			_		TDD
	40	2300 MHz –			_		TDD
.	3	1710 MHz –			_		FDD
CA_3-41-42	41	2496 MHz –			_		TDD
	42	3400 MHz -	+		_		
	4	1710 MHz -			_		
CA_4-5-12	5	824 MHz -			_		FDD
	12	699 MHz -			_	746 MHz	
	4	1710 MHz -	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-4-5-12	5	824 MHz -	849 MHz	869 MHz	-	894 MHz	FDD
	12	699 MHz -	716 MHz	729 MHz	-	746 MHz	
	4	1710 MHz -	1755 MHz	2110 MHz	_	2155 MHz	
CA_4-5-13	5	824 MHz -	849 MHz	869 MHz	_	894 MHz	FDD
	13	777 MHz –	787 MHz	746 MHz	_	756 MHz	
	4	1710 MHz -	1755 MHz		_	2155 MHz	
CA_4-5-29	5				_		FDD
- -	29	L			_		
	4	1710 MHz			_		
CA_4-5-30	5				_		FDD
0/(_1000	30	2305 MHz -			_		1 1 2 2
	4	1710 MHz -					
CA_4-4-5-30	5	824 MHz -					FDD
OA_+-+-0-00	30	00051411					100
	4						
CA 4740	7	1710 MHz - 2500 MHz -					FDD
CA_4-7-12		699 MHz -					FDD
	12	+			_		
04 440 00	4	1710 MHz —			_		
CA_4-12-30	12	699 MHz –			_		FDD
	30	2305 MHz -			_		
CA_4-4-12-	4	1710 MHz -			_		
30	30 12 699 MHZ - 7 16 M			_		FDD	
	30	2305 MHz -	+		_		
	4	1710 MHz -			_		_
CA_4-29-30	29				_		FDD
	30	2305 MHz -		2350 MHz	_	2360 MHz	
CA_4-4-29-	4	1710 MHz -	1755 MHz	2110 MHz	_	2155 MHz]
CA_4-4-29- 30	29			717 MHz	_	728 MHz	FDD
	30	2305 MHz -	2315 MHz	2350 MHz	_	2360 MHz	
CA 7 9 20	7	2500 MHz -	2570 MHz	2620 MHz	L-	2690 MHz	EDD
CA_7-8-20	8	880 MHz -	915 MHz	925 MHz	_	960 MHz	FDD
					_		

	20	832 MHz	-	862 MHz	791 MHz	_	821 MHz			
	7		N/A	4	2620 MHz	-	2690 MHz	FDD		
CA_7-20-38	20	832 MHz	ı	862 MHz	791 MHz	-	821 MHz	רטט		
	38		N/A	4	2570 MHz	-	2620 MHz	TDD		
	19	830 MHz	ı	845 MHz	875 MHz	-	890 MHz	FDD		
CA_19-21-42	21	1447.9 MHz	1	1462.9 MHz	1495.9 MHz	-	1510.9 MHz	FDD		
	42	3400 MHz	ı	3600 MHz	3400 MHz	-	3600 MHz	TDD		
NOTE 1: The	NOTE 1: The frequency range in band 28 is restricted for this CA band combination.									

Table 5.5A-2b: Inter-band CA operating bands (four bands)

E-UTRA CA	E-UTRA	Uplink (UL)	ор	erating band	Downlink (D	L) c	perating band	Duplex
Band	Band	BS receive) / :	JE transmit	BS transi	mit /	UE receive	Mode
		F _{UL_low}	_	F _{UL_high}	F _{DL_lo}	w –	F _{DL_high}	
	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz	
CA_1-3-5-40	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_1-3-3-40	5	824 MHz	_	849 MHz	869 MHz	-	894 MHz	
	40	2300 MHz	_	2400 MHz	2300 MHz	-	2400 MHz	TDD
	1	1920 MHz		1980 MHz	2110 MHz	-	2170 MHz	
CA 4 2 7 0	3	1710 MHz	-	1785 MHz	1805 MHz	-	1880 MHz	FDD
CA_1-3-7-8	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	רטט
	8	880 MHz	-	915 MHz	925 MHz	-	960 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA 4 2 7 20	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_1-3-7-28	7	2500 MHz	-	2570 MHz	2620 MHz	_	2690 MHz	FDD
	28	703 MHz	1	748 MHz	758 MHz	_	803 MHz	
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
04 4 0 0 40	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
CA_1-3-8-40	8	880 MHz	_	915 MHz	925 MHz	_	960 MHz	
	40	2300 MHz	_	2400 MHz	2300 MHz	_	2400 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-3-19-	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD
42	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	
	42	3400 MHz	_	3600 MHz	3400 MHz	_	3600 MHz	TDD
	1	1920 MHz	_	1980 MHz	2110 MHz	_	2170 MHz	
CA_1-19-21-	19	830 MHz	_	845 MHz	875 MHz	_	890 MHz	FDD
42	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz	
	42	3400 MHz	-	3600 MHz 3400 MHz - 3600 MHz		TDD		
	2	1850 MHz	-	1910 MHz	1930 MHz	_	1990 MHz	
04 0 4 5 40	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_2-4-5-12	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
04 0 4 5 00	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
CA_2-4-5-29	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	29	•	N/A	A	717 MHz	_	728 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
04 0 4 5 00	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	500
CA_2-4-5-30	5	824 MHz	_	849 MHz	869 MHz	_	894 MHz	FDD
	30	2305 MHz	-	2315 MHz	2350 MHz	_	2360 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
04 0 4 7 40	4	4740 1411	-	1755 MHz	2110 MHz	_	2155 MHz	
CA_2-4-7-12	7	2500 MHz	-	2570 MHz	2620 MHz	_	2690 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA 2-4-12-	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
30	12	699 MHz	_	716 MHz	729 MHz	_	746 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	1
	2	1850 MHz	_	1910 MHz	1930 MHz	_	1990 MHz	
CA_2-4-29-	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	
30	29	·	N/A		717 MHz	-	728 MHz	FDD
	30	2305 MHz	_	2315 MHz	2350 MHz	_	2360 MHz	1

Table 5.5A-3: Intra-band non-contiguous CA operating bands (with two sub-blocks)

E-UTRA	E-UTRA	Uplink (UL)	ope	rating band	Downlink (D	Downlink (DL) operating band				
CA Band	Band	BS receive	BS receive / UE transmit				BS transmit / UE receive			
		F _{UL_low}	F _{UL_high}	F _{DL_lo}	$F_{DL_low} - F_{DL_high}$					
CA_2-2	2	1850 MHz	-	1910 MHz	1930 MHz	-	1990 MHz	FDD		
CA_3-3	3	1710 MHz	_	1785 MHz	1805 MHz	_	1880 MHz	FDD		
CA_4-4	4	1710 MHz	_	1755 MHz	2110 MHz	_	2155 MHz	FDD		
CA_5-5	5	824 MHz	-	849 MHz	869 MHz	_	894 MHz	FDD		
CA_7-7	7	2500 MHz	_	2570 MHz	2620 MHz	_	2690 MHz	FDD		
CA_23-23	23	2000 MHz	_	2020 MHz	2180 MHz	_	2200 MHz	FDD		
CA_25-25	25	1850 MHz	-	1915 MHz	1930 MHz	-	1995 MHz	FDD		
CA_40-40	40	2300 MHz	-	2400 MHz	2300 MHz	_	2400 MHz	TDD		
CA_41-41	41	2496 MHz	-	2690 MHz	2496 MHz	_	2690 MHz	TDD		
CA_42-42	42	3400 MHz	-	3600 MHz	3400 MHz	-	3600 MHz	TDD		
CA_66-66	66	1710 MHz	ı	1780 MHz	2110 MHz	-	2200 MHz	FDD		

5.5B Operating bands for UL-MIMO

E-UTRA UL-MIMO is designed to operate in the operating bands defined in Table 5.5B-1.

Table 5.5B-1: Void

5.5C Operating bands for Dual Connectivity

E-UTRA dual connectivity is designed to operate in the operating bands defined in Table 5.5C-1.

Table 5.5C-1: Inter-band dual connectivity operating bands (two bands)

E-UTRA	E-		_	erating band) operating band	Duplex
DC Band	UTRA			IE transmit		t / UE receive	Mode
	Band		, –	F _{UL_high}		- F _{DL_high}	
DC_1-3	1	1920 MHz	_	1980 MHz	2110 MHz	– 2170 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	– 1880 MHz	
DC_1-5	1	1920 MHz	_	1980 MHz	2110 MHz	2170 MHz	FDD
DC_1-3	5	824 MHz	_	849 MHz	869 MHz	– 894 MHz	יטט ו
DC 17	1	1920 MHz	_	1980 MHz	2110 MHz	- 2170 MHz	EDD
DC_1-7	7	2500 MHz	_	2570 MHz	2620 MHz	- 2690 MHz	FDD
DO 4.0	1	1920 MHz	_	1980 MHz	2110 MHz	– 2170 MHz	EDD
DC_1-8	8	880 MHz	_	915 MHz	925 MHz	- 960 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz	– 2170 MHz	
DC_1-19	19	830 MHz	_	845 MHz	875 MHz	– 890 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz	– 2170 MHz	
DC_1-21	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	– 1510.9 MHz	FDD
	1	1920 MHz	_	1980 MHz	2110 MHz	– 2170 MHz	
DC_1-42	42	3400 MHz		3600 MHz	3400 MHz	- 3600 MHz	FDD
	2	1850 MHz		1910 MHz	1930 MHz	- 1990 MHz	
DC_2-4	4	1710 MHz	_	1755 MHz	2110 MHz	- 2155 MHz	FDD
			_		t		
DC_2-5	2	1850 MHz	_	1910 MHz	1930 MHz	- 1990 MHz	FDD
	5	824 MHz	_	849 MHz	869 MHz	- 894 MHz	
DC_2-12	2	1850 MHz	_	1910 MHz	1930 MHz	– 1990 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	- 746 MHz	
DC_2-13	2	1850 MHz	_	1910 MHz	1930 MHz	– 1990 MHz	FDD
DO_2 10	13	777 MHz	_	787 MHz	746 MHz	– 756 MHz	
DC_3-5	3	1710 MHz	_	1785 MHz	1805 MHz	– 1880 MHz	FDD
DC_5-5	5	824 MHz	_	849 MHz	869 MHz	– 894 MHz	יטט ו
DC 2.7	3	1710 MHz	_	1785 MHz	1805 MHz	- 1880 MHz	EDD
DC_3-7	7	2500 MHz	_	2570 MHz	2620 MHz	- 2690 MHz	FDD
DO 0.0	3	1710 MHz	_	1785 MHz	1805 MHz	- 1880 MHz	EDD
DC_3-8	8	880 MHz	_	915 MHz	925 MHz	- 960 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	- 1880 MHz	
DC_3-19	19	830 MHz	_	845 MHz	875 MHz	- 890 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	- 1880 MHz	
DC_3-20	20	832 MHz	_	862 MHz	791 MHz	- 821 MHz	FDD
	3	1710 MHz	_	1785 MHz	1805 MHz	- 1880 MHz	
DC_3-26	26	814 MHz	_	849 MHz	859 MHz	- 894 MHz	FDD
	4	1710 MHz	_	1755 MHz	2110 MHz	- 2155 MHz	
DC_4-5	5	824 MHz		849 MHz			FDD
	_		_				
DC_4-7	4	1710 MHz	_	1755 MHz	2110 MHz	- 2155 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	- 2690 MHz	
DC_4-12	4	1710 MHz	_	1755 MHz	2110 MHz	- 2155 MHz	FDD
	12	699 MHz	_	716 MHz	729 MHz	- 746 MHz	
DC_4-13	4	1710 MHz	_	1755 MHz	2110 MHz	– 2155 MHz	FDD
	13	777 MHz	_	787 MHz	746 MHz	– 756 MHz	
DC_4-17	4	1710 MHz	_	1755 MHz	2110 MHz	– 2155 MHz	FDD
	17	704 MHz	_	716 MHz	734 MHz	– 746 MHz	
DC_5-7	5	824 MHz	_	849 MHz	869 MHz	– 894 MHz	FDD
DC_5-1	7	2500 MHz	_	2570 MHz	2620 MHz	 2690 MHz 	יטט ו
DC 5 40	5	824 MHz	L-	849 MHz	869 MHz	– 894 MHz	EDD
DC_5-12	12	699 MHz	_	716 MHz	729 MHz	- 746 MHz	FDD
DC 5 47	5	824 MHz	_	849 MHz	869 MHz	- 894 MHz	
DC_5-17	17	704 MHz	_	716 MHz	734 MHz	- 746 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	- 2690 MHz	
DC_7-20	20	832 MHz	_	862 MHz	791 MHz	- 821 MHz	FDD
	7	2500 MHz	_	2570 MHz	2620 MHz	- 2690 MHz	
DC_7-28	28	703 MHz		748 MHz	758 MHz	- 803 MHz	FDD
	19	830 MHz	_	845 MHz	875 MHz	- 890 MHz	
DC_19-21		1447.9 MHz	Ë	1462.9 MHz	1495.9 MHz		FDD
	21	1441.9 IVITZ	_	1402.9 IVIDZ	1490.9 MIUZ	– 1510.9 MHz	

DC 39-41	39	1880 MHz	_	1920 MHz	1880 MHz	-	1920 MHz	TDD
00_39-41	41	2496 MHz	_	2690 MHz	2496 MHz	_	2690 MHz	טטו

Table 5.5C-2: Inter-band dual connectivity operating bands (three bands)

E-UTRA DC	E-UTRA	Uplink (UL) ope	erating band	Downlink (E	Duplex Mode			
Band	E-OTKA Band	BS receiv	JE transmit	BS trans	BS transmit / UE receive				
Barra	Baila	F _{UL_lo}	F _{UL_high}	F _{DL_lo}					
	1	1920 MHz	_	1980 MHz	2110 MHz	-	2170 MHz		
DC_1-3-19	3	1710 MHz	-	1785 MHz	1805 MHz	_	1880 MHz	FDD	
	19	830 MHz	_	845 MHz	875 MHz	-	890 MHz		
	1	1920 MHz	-	1980 MHz	2110 MHz	_	2170 MHz		
DC_1-19-21	19	830 MHz	1	845 MHz	875 MHz	-	890 MHz	FDD	
	21	1447.9 MHz	_	1462.9 MHz	1495.9 MHz	_	1510.9 MHz		

5.5D Operating bands for ProSe

E-UTRA ProSe is designed to operate in the operating bands defined in Table 5.5D-1.

Table 5.5D-1 E-UTRA ProSe operating band

E-UTRA	E-UTRA	ProSe UE transmit	ProSe UE receive	ProSe	ProSe	Direct
ProSe Band	Operating Band	Ful_low - Ful_high	FDL_low - FDL_high	Duplex Mode	Disc.	Comm.
2	2	1850 MHz - 1910 MHz	1850 MHz - 1910 MHz	HD	Yes	
3	3	1710 MHz – 1785 MHz	1710 MHz - 1785 MHz	HD	Yes	Yes
4	4	1710 MHz - 1755 MHz	1710 MHz - 1755 MHz	HD	Yes	
7	7	2500 MHz - 2570 MHz	2500 MHz - 2570 MHz	HD	Yes	Yes
14	14	788 MHz – 798 MHz	788 MHz - 798 MHz	HD	Yes	Yes
20	20	832 MHz - 862 MHz	832 MHz - 862 MHz	HD	Yes	Yes
26	26	814 MHz – 849 MHz	814 MHz - 849 MHz	HD	Yes	Yes
28	28	703 MHz - 748 MHz	703 MHz - 748 MHz	HD	Yes	Yes
31	31	452.5 MHz - 457.5 MHz	452.5 MHz - 457.5 MHz	HD	Yes	Yes
41	41	2496 MHz - 2690 MHz	2496 MHz - 2690 MHz	HD	Yes	
68	68	698 MHz - 728 MHz	698 MHz - 728 MHz	HD	Yes	Yes

E-UTRA ProSe is designed to operate concurrent with E-UTRA uplink/downlink on the operating bands combinations listed in Table 5.5D-2.

Table 5.5D-2 Inter-band E-UTRA ProSe / E-UTRA operating bands

E-UTRA ProSe Band Note 1	E-UTRA band / E-UTRA CA band Note					
2	4					
2	CA_2-4 ^{Note 3}					
28	1					
20	CA_1-28 ^{Note 3}					
NOTE 1: As specified in Ta	ble 5.5D-1					
NOTE 2: As specified in Ta	ble 5.5-1 and Table 5.5A-2					
NOTE 3: Applies when E-U	JTRA uplink is assigned to one E-UTRA					
band and ProSe of	peration is restricted to the uplink					
frequencies paired	with either PCC or SCC.					
NOTE 4: The concurrency f	or E-UTRA ProSe Direct Discovery with					
E-UTRA uplink/do	ownlink applies after allowing for any					
transmission and/	or reception gap requested by the UE.					

5.5E Operating bands for UE category 0 and UE category M1

UE category 0 is designed to operate in the E-UTRA operating bands 2, 3, 4, 5, 8, 13, and 20 in both half duplex FDD mode and full-duplex FDD mode and in bands 39 and 41 in TDD mode. The E-UTRA bands are defined in Table 5.5-1.

UE category M1 is designed to operate in the E-UTRA operating bands 1, 2, 3, 4, 5, 7, 8, 11, 12, 13, 18, 19, 20, 21, 26, 27, 28, and 31 in both half duplex FDD mode and full-duplex FDD mode, and in bands 39 and 41 in TDD mode. The E-UTRA bands are defined in Table 5.5-1.

5.5F Operating bands for category NB1

Category NB1 is designed to operate in the E-UTRA operating bands 1, 2, 3, 5, 8, 12, 13, 17, 18, 19, 20, 26, 28, 66 which are defined in Table 5.5-1. Category NB1 system operates in HD-FDD duplex mode.

5.6 Channel bandwidth

Requirements in present document are specified for the channel bandwidths listed in Table 5.6-1.

Table 5.6-1: Transmission bandwidth configuration N_{RB} in E-UTRA channel bandwidths

Channel bandwidth BW _{Channel} [MHz]	1.4	3	5	10	15	20
Transmission bandwidth configuration N _{RB}	6	15	25	50	75	100

Figure 5.6-1 shows the relation between the Channel bandwidth ($BW_{Channel}$) and the Transmission bandwidth configuration (N_{RB}). The channel edges are defined as the lowest and highest frequencies of the carrier separated by the channel bandwidth, i.e. at $F_C + /- BW_{Channel} / 2$.

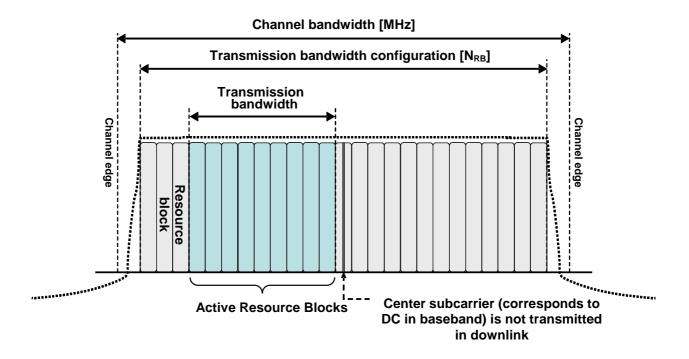


Figure 5.6-1: Definition of channel bandwidth and transmission bandwidth configuration for one E-UTRA carrier

5.6.1 Channel bandwidths per operating band

a) The requirements in this specification apply to the combination of channel bandwidths and operating bands shown in Table 5.6.1-1. The transmission bandwidth configuration in Table 5.6.1-1 shall be supported for each of the specified channel bandwidths. The same (symmetrical) channel bandwidth is specified for both the TX and RX path.

Table 5.6.1-1: E-UTRA channel bandwidth

E-UTRA band / Channel bandwidth										
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz				
1			Yes	Yes	Yes	Yes				
2	Yes	Yes	Yes	Yes	Yes ¹	Yes ¹				
3	Yes	Yes	Yes	Yes	Yes ¹	Yes ¹				
4	Yes	Yes	Yes	Yes	Yes	Yes				
5	Yes	Yes	Yes	Yes ¹						
6			Yes	Yes ¹						
7			Yes	Yes	Yes ³	Yes ^{1, 3}				
8	Yes	Yes	Yes	Yes ¹						
9			Yes	Yes	Yes ¹	Yes ¹				
10			Yes	Yes	Yes	Yes				
11			Yes	Yes ¹						
12	Yes	Yes	Yes ¹	Yes ¹						
13			Yes ¹	Yes ¹						
14			Yes ¹	Yes ¹						
17			Yes ¹	Yes ¹						
18			Yes	Yes ¹	Yes ¹					
19			Yes	Yes ¹	Yes ¹					
20			Yes	Yes ¹	Yes ¹	Yes ¹				
21			Yes	Yes ¹	Yes ¹					
22			Yes	Yes	Yes ¹	Yes ¹				
23	Yes	Yes	Yes	Yes	Yes ¹	Yes ¹				
24			Yes	Yes						
25	Yes	Yes	Yes	Yes	Yes ¹	Yes ¹				
26	Yes	Yes	Yes	Yes ¹	Yes ¹					
27	Yes	Yes	Yes	Yes ¹						
28		Yes	Yes	Yes ¹	Yes ¹	Yes ^{1, 2}				
30			Yes	Yes ¹						
31	Yes	Yes ¹	Yes ¹							
33			Yes	Yes	Yes	Yes				
34			Yes	Yes	Yes					
35	Yes	Yes	Yes	Yes	Yes	Yes				
36	Yes	Yes	Yes	Yes	Yes	Yes				
37			Yes	Yes	Yes	Yes				
38			Yes	Yes	Yes ³	Yes ³				
39			Yes	Yes	Yes ³	Yes ³				
40			Yes	Yes	Yes	Yes				
41			Yes	Yes	Yes	Yes				
42			Yes	Yes	Yes	Yes				
43			Yes	Yes	Yes	Yes				
44		Yes	Yes	Yes	Yes	Yes				
45		. 55	Yes	Yes	Yes	Yes				
46			. 55	1.55	. 55	Yes				
						. 55				
64			Rese	erved						
65	Yes	Yes	Yes	Yes	Yes	Yes				
66	Yes	Yes	Yes	Yes	Yes	Yes				
68			Yes	Yes	Yes ⁴					

- NOTE 1: ¹ refers to the bandwidth for which a relaxation of the specified UE receiver sensitivity requirement (subclause 7.3) is allowed.
- NOTE 2: ² For the 20 MHz bandwidth, the minimum requirements are specified for E-UTRA UL carrier frequencies confined to either 713-723 MHz or 728-738 MHz
- NOTE 3: ³ refers to the bandwidth for which the uplink transmission bandwidth can be restricted by the network for some channel assignments in FDD/TDD co-existence scenarios in order to meet unwanted emissions requirements (Clause 6.6.3.2).
- NOTE 4: ⁴ For the 15 MHz bandwidth, the minimum requirements are specified for E-UTRA UL carrier frequencies confined to either 705.5 MHz or 710.5-720.5 MHz

b) The use of different (asymmetrical) channel bandwidth for the TX and RX is not precluded and is intended to form part of a later release.

5.6A Channel bandwidth for CA

For intra-band contiguous carrier aggregation *Aggregated Channel Bandwidth*, *Aggregated Transmission Bandwidth Configuration* and *Guard Bands* are defined as follows, see Figure 5.6A-1.

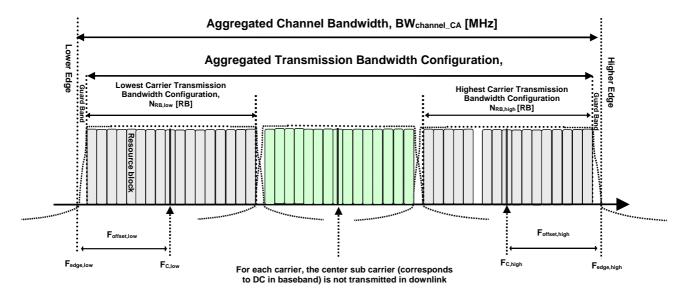


Figure 5.6A-1. Definition of Aggregated channel bandwidth and aggregated channel bandwidth edges

The aggregated channel bandwidth, BW_{Channel_CA}, is defined as

$$BW_{Channel_CA} = F_{edge,high} - F_{edge,low}$$
 [MHz].

The lower bandwidth edge $F_{\text{edge,low}}$ and the upper bandwidth edge $F_{\text{edge,high}}$ of the aggregated channel bandwidth are used as frequency reference points for transmitter and receiver requirements and are defined by

$$F_{edge,low} = F_{C,low} - F_{offset,low}$$

$$F_{edge,high} = F_{C,high} + F_{offset,high}$$

The lower and upper frequency offsets depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carrier and are defined as

$$F_{\text{offset,low}} = (0.18N_{\text{RB,low}} + \Delta f_1)/2 + BW_{\text{GB}} [\text{MHz}]$$

$$F_{offset,high} = (0.18N_{RB,high} + \Delta f_1)/2 + BW_{GB}[MHz]$$

where $\Delta f_1 = \Delta f$ for the downlink with Δf the subcarrier spacing and $\Delta f_1 = 0$ for the uplink, while $N_{RB,low}$ and $N_{RB,high}$ are the transmission bandwidth configurations according to Table 5.6-1 for the lowest and highest assigned component carrier, respectively. BW_{GB} denotes the *Nominal Guard Band* and is defined in Table 5.6A-1, and the factor 0.18 is the PRB bandwidth in MHz.

NOTE: The values of BW_{Channel_CA} for UE and BS are the same if the lowest and the highest component carriers are identical.

Aggregated Transmission Bandwidth Configuration is the number of the aggregated RBs within the fully allocated Aggregated Channel bandwidth and is defined per CA Bandwidth Class (Table 5.6A-1).

For intra-band non-contiguous carrier aggregation *Sub-block Bandwidth* and *Sub-block edges* are defined as follows, see Figure 5.6A-2.

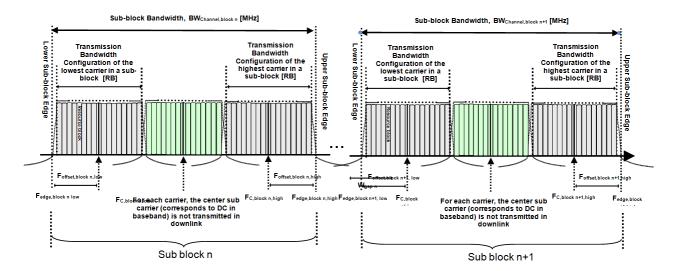


Figure 5.6A-2. Non-contiguous intraband CA terms and definitions

The lower sub-block edge of the Sub-block Bandwidth (BW_{Channel,block}) is defined as

$$F_{\text{edge,block, low}} = F_{\text{C,block,low}} - F_{\text{offset,block, low}}$$

The upper sub-block edge of the Sub-block Bandwidth is defined as

$$F_{edge,block,high} = F_{C,block,high} + F_{offset,block,high}$$

The Sub-block Bandwidth, BW_{Channel,block}, is defined as follows:

$${\scriptstyle BWChannel, block} = F_{edge, block, high -} F_{edge, block, low \ [MHz]}$$

The lower and upper frequency offsets $F_{offset,block,low}$ and $F_{offset,block,high}$ depend on the transmission bandwidth configurations of the lowest and highest assigned edge component carriers within a sub-block and are defined as

$$F_{offset,block,low} = (0.18N_{RB,low} + \Delta f_1)/2 + BW_{GB}[MHz]$$

$$F_{offset,block,high} = (0.18N_{RB,high} + \Delta f_1)/2 + BW_{GB} [MHz]$$

where $\Delta f_1 = \Delta f$ for the downlink with Δf the subcarrier spacing and $\Delta f_1 = 0$ for the uplink, while $N_{RB,low}$ and $N_{RB,high}$ are the transmission bandwidth configurations according to Table 5.6-1 for the lowest and highest assigned component carrier within a sub-block, respectively. BW_{GB} denotes the *Nominal Guard Band* and is defined in Table 5.6A-1, and the factor 0.18 is the PRB bandwidth in MHz.

The sub-block gap size between two consecutive sub-blocks W_{gap} is defined as

$$W_{gap} = F_{edge,block n+1,low} - F_{edge,block n,high [MHz]}$$

Table 5.6A-1: CA bandwidth classes and corresponding nominal guard bands

CA Bandwidth Class	Aggregated Transmission Bandwidth Configuration	Number of contiguous CC	Nominal Guard Band BW _{GB}
Α	N _{RB,agg} ≤ 100	1	a₁ BW _{Channel(1)} - 0.5∆f₁ (NOTE 2)
В	25 < N _{RB,agg} ≤ 100	2	0.05 $max(BW_{Channel(1)},BW_{Channel(2)})$ - 0.5 Δf_1
С	100 < N _{RB,agg} ≤ 200	2	$0.05 \ max(BW_{Channel(1)},BW_{Channel(2)}) - 0.5\Delta f_1$
D	200 < N _{RB,agg} ≤ 300	3	0.05 $max(BW_{Channel(1)},BW_{Channel(2)}, BW_{Channel(3)}) - 0.5\Delta f_1$
E	300 < N _{RB,agg} ≤ 400	4	$0.05~max(BW_{Channel(1)},BW_{Channel(2)}, BW_{Channel(3)}, BW_{Channel(4)}) - 0.5\Delta f_1$
F	400 < N _{RB,agg} ≤ 500	5	NOTE 3
	$700 < N_{RB,agg} \le 800$	8	NOTE 3

NOTE 1: BW_{Channel(j)}, j = 1, 2, 3, 4 is the channel bandwidth of an E-UTRA component carrier according to Table 5.6-1 and $\Delta f_1 = \Delta f$ for the downlink with Δf the subcarrier spacing while $\Delta f_1 = 0$ for the uplink.

NOTE 2: $a_1 = 0.16/1.4$ for BW_{Channel(1)} = 1.4 MHz whereas $a_1 = 0.05$ for all other channel bandwidths.

NOTE 3: Applicable for later releases.

The channel spacing between centre frequencies of contiguously aggregated component carriers is defined in subclause 5.7.1A.

5.6A.1 Channel bandwidths per operating band for CA

The requirements for carrier aggregation in this specification are defined for carrier aggregation configurations with associated bandwidth combination sets. For inter-band carrier aggregation, a *carrier aggregation configuration* is a combination of operating bands, each supporting a carrier aggregation bandwidth class. For intra-band contiguous carrier aggregation, a carrier aggregation configuration is a single operating band supporting a carrier aggregation bandwidth class.

For each carrier aggregation configuration, requirements are specified for all bandwidth combinations contained in a *bandwidth combination set*, which is indicated per supported band combination in the UE radio access capability. A UE can indicate support of several bandwidth combination sets per band combination.

Requirements for intra-band contiguous carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-1. Requirements for inter-band carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-2, Table 5.6A.1-2a. and Table 5.6A.1-2b Requirements for intra-band non-contiguous carrier aggregation are defined for the carrier aggregation configurations and bandwidth combination sets specified in Table 5.6A.1-3.

The DL component carrier combinations for a given CA configuration shall be symmetrical in relation to channel centre unless stated otherwise in Table 5.6A.1-1, Table 5.6A.1-2, Table 5.6A.1-2a and Table 5.6A.1-2b.

Table 5.6A.1-1: E-UTRA CA configurations and bandwidth combination sets defined for intra-band contiguous CA

	Uplink CA	E-UTRA CA configuration / Bandwidth combination set Component carriers in order of increasing carrier frequency										
E-UTRA CA configuratio n	configurat ions (NOTE 3)	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidths for carrier [MHz]	Channel bandwidth s for carrier [MHz]	Maximum aggregated bandwidth [MHz]	Bandwidth combinatio n set					
CA_1C	CA_1C	15	15			40	0					
	00	20	20									
		5	20									
CA_2C		10	15, 20			40	0					
	6/(<u>-</u> 26	15	10, 15, 20									
		20	5, 10, 15, 20									
CA_3C	CA_3C	5, 10, 15	20			40	0					
	5. 5.7	20	5, 10, 15, 20				-					
CA_5B		5, 10	10			20	0					
		10	5			20						
CA_7B		15	5			20	0					
		15	15			40	0					
		20	20			40						
		10	20									
CA_7C	CA_7C	15	15, 20			40	1					
		20	10, 15, 20									
		15	10, 15			40	0					
		20	15, 20			40	2					
04.05	04.00	5,10	10									
CA_8B	CA_8B	10	5			20	0					
CA_12B	-	5	5, 10			15	0					
		10	10				_					
CA_23B	-	5	15			20	0					
		1.4, 3, 5	5									
CA_27B	-	1.4, 3	10			13	0					
		15	15									
CA_38C	CA_38C	20	20			40	0					
		5,10,15	20									
CA_39C	CA_39C	20	5, 10, 15			35	0					
		10	20									
		15	15			40	0					
		20	10, 20									
CA_40C	CA_40C	10, 15	20									
		15	15			40	1					
		20	10, 15, 20			1						
		10, 15, 20	20	20								
CA_40D	CA_40C	20	10, 15	20		60	0					
		20	20	10, 15		1						
CA_41C	CA_41C	10	20			40	0					

		Ι	1		1	T	ı
		15	15, 20				
		20	10, 15, 20				
		5, 10	20				
		15	15, 20			40	1
		20	5, 10, 15, 20				
		10	15, 20				
		15	10, 15, 20			40	2
		20	10, 15, 20				
		10	20				_
		20	20			40	3
		10	20	15			
		10	15, 20	20			
		15	20	10, 15		1	
CA_41D	CA_41C	15	10, 15, 20	20		60	0
		20	15, 20	10		1	
		20	10, 15, 20	15, 20		1	
		5, 10, 15, 20	20	•		40	0
CA_42C	CA_42C	20	5, 10, 15			40	U
OA_420	UA_420	10, 15, 20	20			40	1
		20	10, 15			.0	
CA_42D	CA_42C	5,10,15,20	20	20		60	0
0/(_12B	6/1 <u>2</u> 6	20	20	5,10,15		00	Ŭ
CA_42E	CA_42C	5,10,15,20	20	20	20	80	0
CA_42E	CA_42C	20	20	20	5,10,15	80	0
		5	5, 10, 15				
CA_66B	-	10	5, 10			20	0
		15	5			1	
		5	20				
		10	15, 20			1	_
CA_66C	-	15	10, 15, 20			40	0
		20	5, 10, 15, 20			1	
	l	l			1	1	i

NOTE 1: The CA configuration refers to an operating band and a CA bandwidth class specified in Table 5.6A-1 (the indexing letter). Absence of a CA bandwidth class for an operating band implies support of all classes.

NOTE 2: For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal. NOTE 3: Uplink CA configurations are the configurations supported by the present release of specifications.

Table 5.6A.1-2: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA (two bands)

	E-U1	RA CA c	onfigur	ation /	Bandw	idth co	mbinat	tion set	:	
E-UTRA CA Configuration	Uplink CA configurations (NOTE 4)	E- UTRA Bands	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Maximum aggregated bandwidth [MHz]	Bandwidth combination set
CA_1A-3A	CA_1A-3A	1			Yes	Yes	Yes	Yes	40	0
		3			Yes	Yes	Yes	Yes	_	_
CA_1A-3C		1	Sec. (24 20	Yes	Yes	Yes nbinatio	Yes	60	0
CA_TA-3C	-	3	See		in Table			n set	00	U
		1		Γ		Yes				_
04 44 54	0.4.4.5.4	5				Yes			20	0
CA_1A-5A	CA_1A-5A	1			Yes	Yes	Yes	Yes	00	4
		5			Yes	Yes			30	1
CA_1A-7A	CA_1A-7A	1			Yes	Yes	Yes	Yes	40	0
OA_IA-IA	OA_IA-IA	7				Yes	Yes	Yes		0
		1			Yes	Yes	Yes	Yes		_
CA_1A-7C	-	7	See (in Table	5.6A.1			60	0
		1			Yes	Yes	Yes	Yes	30	0
		8			Yes	Yes				<u> </u>
CA_1A-8A	CA_1A-8A	1			Yes	Yes			20	1
		8			Yes	Yes	Vaa	Voc		
		8		Yes	Yes Yes	Yes Yes	Yes	Yes	30	2
		1		162	Yes	Yes	Yes	Yes		
CA_1A-11A	-	11			Yes	Yes	163	163	30	0
		1			Yes	Yes	Yes	Yes		
		18			Yes	Yes	Yes	100	35	0
CA_1A-18A	CA_1A-18A	1			Yes	Yes				_
		18			Yes	Yes			20	1
CA 1A 10A	CA 1A 10A	1			Yes	Yes	Yes	Yes	25	0
CA_1A-19A	CA_1A-19A	19			Yes	Yes	Yes		35	0
CA_1A-20A	_	1			Yes	Yes	Yes	Yes	40	0
O/_1/\ 20/\		20			Yes	Yes	Yes	Yes	40	0
CA_1A-21A	CA_1A-21A	1			Yes	Yes	Yes	Yes	35	0
		21			Yes	Yes	Yes			-
		1			Yes	Yes	Yes	Yes	35	0
CA_1A-26A	CA_1A-26A	26 1			Yes	Yes	Yes			
					Yes Yes	Yes			20	1
		26 1			Yes	Yes Yes	Yes	Yes		
		28			Yes	Yes	Yes	Yes	40	0
CA_1A-28A	CA_1A-28A	1			Yes	Yes		. 50		_
		28			Yes	Yes			20	1
CA 4A 40A		1			Yes	Yes	Yes	Yes	40	0
CA_1A-40A	-	40			Yes	Yes	Yes	Yes	40	0
CA_1A-41A ⁶		1			Yes	Yes	Yes	Yes	40	0
ON_IA-+IA	_	41			Yes	Yes	Yes	Yes	70	
04 44 4400		1	_		Yes	Yes	Yes	Yes	0.0	
CA_1A-41C ⁶	-	41	See CA_41C Bandwidth Combination Set 1 in Table 5.6A.1-1						60	0
CA_1A-42A	CA_1A-42A	1			Yes	Yes	Yes	Yes	40	0
<u> </u>	J	42			Yes	Yes	Yes	Yes		, ,
CA 1A 10C		1	0-	CA 40	Yes	Yes	Yes	Yes	60	
CA_1A-42C	-	42	See		0 in Tal	ole 5.6/			60	0
CA_1A-46A	-	1 46			Yes	Yes	Yes	Yes Yes	40	0

		1				1			ı	1
		2	Yes	Yes	Yes	Yes	Yes	Yes	40	0
		2			Yes	Yes Yes	Yes	Yes		
CA_2A-4A	CA_2A-4A	4			Yes Yes	Yes			20	1
		2			Yes	Yes	Yes	Yes		
		4			Yes	Yes	Yes	Yes	40	2
			See	CA 2A-			Combir			
CA_2A-2A-4A	-	2			0 in Tal				60	0
_		4	Yes Yes Yes Yes							
		2			Yes	Yes	Yes	Yes		
CA_2A-4A-4A	-	4	See	_			Combir	nation	60	0
			_		0 in Tal					
04 04 04		2	See	_			Combir	nation		
CA_2A-2A- 4A-4A	-		Soo		0 in Tal		Combir	ation	80	0
7/\-7/\		4	366		0 in Tal			iation		
		2			Yes	Yes	Yes	Yes		_
		5			Yes	Yes			30	0
CA_2A-5A	CA_2A-5A	2			Yes	Yes				_
		5			Yes	Yes			20	1
		2	See	CA_2A-			Combir	ation		
CA_2A-2A-5A	-			Set	0 in Tal		\.1-3	ı	50	0
		5			Yes	Yes				
		2	See				nbinatio	n set		
CA_2C-5A	-			0	in Table		l-1 I	ı	50	0
		5			Yes	Yes		\/		
CA_2A-7A	-	2		-	Yes	Yes	Yes	Yes	40	0
		7			Yes	Yes	Yes	Yes		
		12			Yes Yes	Yes Yes	Yes	Yes	30	0
		2			Yes	Yes	Yes	Yes		
CA_2A-12A	CA_2A-12A	12		Yes	Yes	Yes	res	res	30	1
		2		162	Yes	Yes	-			
		12			Yes	Yes			20	2
			See	CA 2A-			Combir	nation		
CA_2A-2A-	-	2	000		0 in Tal			iation	50	0
12A		12			Yes	Yes				
		2			Yes	Yes	Yes	Yes		
CA_2A-12B	-	12	See				Combina	ation	35	0
					0 in Tal					
04 04 04		2	See	CA_2A						
CA_2A-2A- 12B	-		Soo		0 in Tab		Combina	otion	55	0
126		12	366		0 in Tal			ation		
			See				nbinatio	n set		
CA_2C-12A	-	2			in Table			-	50	0
		12			Yes	Yes				
		2			Yes	Yes	Yes	Yes	30	0
CA_2A-13A	CA_2A-13A	13				Yes			30	J
5/1_Z/1 TO/A	O	2			Yes	Yes			20	1
		13		<u> </u>		Yes				'
CA_2A-2A-	_2A-2A- Set 0 in Table 5.6A.1-3								50	
13A	-	13		Set	um rai	Yes	1.1-3 	I	50	0
		2			Yes	Yes				
CA_2A-17A	-	17			Yes	Yes			20	0
		2			Yes	Yes	Yes	Yes		
CA_2A-28A	-	28			Yes	Yes	Yes	Yes	40	0
		2			Yes	Yes	1.55			_
		29		Yes	Yes	Yes			20	0
CA_2A-29A	-	2			Yes	Yes			22	4
_		29			Yes	Yes			20	1
		2			Yes	Yes	Yes	Yes	30	2
		•	•	•	•		•	•	•	•

	ı	1								ı
		29			Yes	Yes				
		2	See 0				nbinatio	n Set		_
CA_2C-29A	-			0	in table		-1 '	ı	50	0
		29			Yes	Yes		.,		
CA_2A-30A	_	2			Yes	Yes	Yes	Yes	30	0
		30			Yes	Yes				,
		2	See	_	Bandw					
CA_2C-30A	-			0	in Table		-1	ı	50	0
		30			Yes	Yes		.,		
CA_2A-46A	_	2			Yes	Yes	Yes	Yes	40	0
		46						Yes		-
		3				Yes	Yes	Yes	30	0
		5			Yes	Yes				, and the second
		3				Yes			20	1
CA_3A-5A	CA_3A-5A	5			Yes	Yes			20	'
OA_SA-SA	OA_SA-SA	3			Yes	Yes	Yes	Yes	30	2
		5			Yes	Yes			30	2
		3			Yes	Yes	Yes	Yes	30	3
		5		Yes	Yes	Yes			30	3
		2	See (CA_3C	Bandwi	dth Cor	nbinatio	n Set		
CA_3C-5A	-	3			in Table		50	0		
		5			Yes	Yes				
		3			Yes	Yes	Yes	Yes	40	
CA 2A 7A	CA 2A 7A	7				Yes	Yes	Yes	40	0
CA_3A-7A	CA_3A-7A	3			Yes	Yes	Yes	Yes	40	4
		7			Yes	Yes	Yes	Yes	40	1
		3			Yes	Yes	Yes	Yes		
CA_3A-7B	-		See C	A 7B I	pandwid		40	0		
_		7			n table					
		3	Yes Yes Yes Yes							
		7	See	CA_7C	Bandw		nbinatio	n set	60	0
CA 2A 7C	CA_3A-7A	7			in table					
CA_3A-7C	CA_7C	3	Yes Yes Yes Yes							
		7	See CA_7C Bandwidth combination set						60	1
		,			in table					
	CA_3A-7A	3	See 0				nbinatio	n Set		
CA_3C-7A	CA_3C			0	in table		-1 Yes	Yes	60	0
	0/1_00	7			Yes	Yes				
		3	See 0				nbinatio	n Set		
CA_3C-7C	-		0 in Table 5.6A.1-1 See CA_7C Bandwidth Combination Set						80	0
		7	See (n Set		
		2	-	<u> 2</u>	in Table			Voc		
		3			V	Yes	Yes	Yes	30	0
		8			Yes	Yes	-			
		3			\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Yes	<u> </u>		20	1
CA_3A-8A	CA_3A-8A	8			Yes	Yes	\			
		3		ļ.,-	Yes	Yes	Yes	Yes	30	2
		8		Yes	Yes	Yes				_
		3			Yes	Yes	Yes	Yes	30	3
		8			Yes	Yes	<u> </u>			
		3	See				Combir	nation	50	_
				Set	0 in tab		.1-3	1		0
CA_3A-3A-8A	_	8	-	<u> </u>	Yes	Yes	<u> </u>	<u></u>		
		3	See C				Combin	ation	40	
		0		Se	t 1 in ta		A.1-პ 	1	40	1
		8			Yes	Yes	\/	V		
CA_3A-19A	CA_3A-19A	3			Yes	Yes	Yes	Yes	35	0
		19			Yes	Yes	Yes		-	_
		3			Yes	Yes	Yes	Yes	30	0
CA_3A-20A	CA_3A-20A	20			Yes	Yes	ļ.,			0
55, , 25, ,		3			Yes	Yes	Yes	Yes	40	1
		20			Yes	Yes	Yes	Yes		
CA_3A-26A	CA_3A-26A	3			Yes	Yes	Yes	Yes	35	0

26	1		00	1	1	Vaa	Vaa	Vaa	1		1
CA_3A-27A - 27			26	-	-	Yes	Yes	Yes			
CA 3A-27A - 3 Yes Yes Yes yes 0 0 CA_3A-28A - 27 Yes Yes Yes Yes Yes Yes 40 0 CA_3A-28A - 28 Yes										20	1
CA_3A-2BA - 27								Vaa	Vaa		
CA 3A-28A -	CA_3A-27A	-						Yes	res	30	0
CA_3A-28A - 28	_										
CA_3C-28A	CA 3A-28A	-		-	-					40	0
CA_3A-28A - CA_3A-31A - 3											
CA_3A-31A . 3			3	See (on Set		
CA_3A-31A - 3 Ves Ves Yes Yes </td <td>CA_3C-28A</td> <td>-</td> <td></td> <td></td> <td>0</td> <td></td> <td></td> <td></td> <td></td> <td>60</td> <td>0</td>	CA_3C-28A	-			0					60	0
CA_3A-3FA - 31											
CA_3A-38A	CA 3A-31A	-					Yes	Yes	Yes	25	0
CA_3A-40A - 38					Yes						
CA_3A-40A	CA 3A-38A	_								40	0
CA_3A-40A - 40	G/1_G/1 GG/1										, ,
August A	CA 3A-40A	_				Yes	Yes	Yes	Yes	40	0
CA_3A-40C	UA_3A-40A		40			Yes	Yes	Yes	Yes	40	U
Set 1 in Table 5.6A.1-1											
CA_3A-41A	CA_3A-40C	-	40	See	CA_40	C Band	lwidth C	Combina	ation	60	0
CA_3A-41A -					Set	1 in Tal	ole 5.6 <i>P</i>	۱.1-1			
CA_3A-41C -	CA 2A 44 A		3			Yes	Yes	Yes	Yes	40	0
CA_3A-41C 41 See CA_41C Bandwidth Combination Set 0 in Table 5.6A.1-1 60 0 CA_3A-42A - 3 Yes Yes Yes Yes Yes O CA_3A-42C - 42 See CA_42C Bandwidth Combination Set 0 in Table 5.6A.1-1 60 0 CA_3A-46A - 46 Yes Yes Yes Yes CA_4A-5A - 46 Yes Yes Yes Yes CA_4A-5A - 46 Yes Yes Yes Yes CA_4A-5A - 46 Yes Yes <td>CA_3A-41A</td> <td>-</td> <td>41</td> <td></td> <td></td> <td>Yes</td> <td>Yes</td> <td>Yes</td> <td>Yes</td> <td>40</td> <td>U</td>	CA_3A-41A	-	41			Yes	Yes	Yes	Yes	40	U
CA_3A-42A - 33			3			Yes	Yes	Yes	Yes		
CA_3A-42A - 33	CA_3A-41C	-	44	See	CA_41	C Band	width C	Combina	ation	60	0
CA_3A-42A -			41								
CA_3A-42C -	CA 2A 42A		3			Yes	Yes	Yes	Yes	40	0
CA_3A-42C - 42 See CA_42C Bandwidth Combination Set 0 in Table 5.6A.1-1 60 0 CA_3A-46A - 3 Yes Yes Yes Yes 40 0 CA_4A-5A 46 Yes Yes Yes Yes 20 0 CA_4A-5A CA_4A-5A Yes	CA_3A-42A	-	42			Yes	Yes	Yes	Yes	40	U
Set 0 in Table 5.6A.1-1			3			Yes	Yes	Yes	Yes		
Set 0 in Table 5.6A.1-1	CA_3A-42C	-		See	CA 42		lwidth C			60	0
CA_3A-46A - 3 Yes Yes Yes 40 0 CA_4A-5A 4 Yes Yes Yes 20 0 CA_4A-5A 5 Yes											
CA_4A-5A CA_4A-5A CA_4A-5A CA_4A-6A CA_4A-7A CA_4A-12A CA_4A-12A	04 04 404		3						Yes	40	0
CA_4A-5A 4 Yes Yes 20 0 CA_4A-5A 5 Yes Yes Yes Yes 30 1 CA_4A-4A-5A - 4 See CA_4A-4A Bandwidth Combination Set 0 in table 5.6A.1-3 50 0 CA_4A-7A - 4 Yes Yes Yes Yes CA_4A-7A CA_4A-7A 7 Yes Yes Yes Yes CA_4A-7A CA_4A-7A 7 Yes Yes Yes Yes CA_4A-7A 4 Yes Yes <td>CA_3A-46A</td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>40</td> <td>0</td>	CA_3A-46A	-								40	0
CA_4A-5A CA_4A-5A 5 Yes Yes <th< td=""><td></td><td></td><td></td><td></td><td></td><td>Yes</td><td>Yes</td><td></td><td></td><td></td><td>_</td></th<>						Yes	Yes				_
CA_4A-5A CA_4A-5A CA_4A-5A CA_4A-5A CA_4A-6A CA_4A-6A CA_4A-6A CA_4A-6A CA_4A-6A CA_4A-6A CA_4A-7A CA_4A-										20	0
See CA_4A-4A Bandwidth Combination Set 0 in table 5.6A.1-3 50 0	CA_4A-5A	CA_4A-5A						Yes	Yes		
CA_4A-4A-5A - 4 See CA_4A-4A Bandwidth Combination Set 0 in table 5.6A.1-3 50 0 The second of table 5.6A.1-3 50 0 CA_4A-4A-5A								100	100	30	1
CA_4A-4A-5A CA_4A-7A CA_4A-1A-7A CA_4A-1A-1A-7A CA_4A-1A-7A CA_4A-1A-1A-7A CA_4A-1A-7A CA_4A-1A-1A-1A CA_4A-1A-1A CA_				See	CA 4A-			Combir	nation		
CA_4A-7A CA_4A-12A CA_4A-12A CA_4A-12A CA_4A-12A CA_4A-4A-7A CA_4A-4A-7A CA_4A-4A-7A CA_4A-12A CA_4A-1A	CA 4A-4A-5A	_	4						iation	50	0
CA_4A-7A CA_4A-			5								
CA_4A-7A CA_4A-											
CA_4A-7A CA_4A-7A CA_4A-7A CA_4A-7A CA_4A-7A A								Yes	Yes	30	0
CA_4A-12A CA_4A-12A CA_4A-4A-7 CA_4A-4A	CA_4A-7A	CA_4A-7A									
CA_4A-4A-7A - 4				-	-					40	1
CA_4A-4A-7A -				 	 			163	163		
CA_4A-4A-7A -				 	 					40	0
CA_4A-4A-7A - 4				-	-			Voc	Voc	40	
CA_4A-12A CA_4A-4A-4 CA_4A-4A-4 CA_4A-4A-4A-4A-4A-4A-4A-4A-4A-4A-4A-4A-4A-4	CA_4A-4A-7A	-		 	 						
T				1	1					00	
CA_4A-12A CA_4A-12A CA_4A-4A-4A- CA_4A-4A-4A-4A- CA_4A-4A-4A-4A-4A-4A-4A-4A-4A-4A-4A-4A-4A-4				<u> </u>	<u> </u>					60	1
12								Yes	Yes		
CA_4A-12A				Yes	Yes					20	0
CA_4A-12A										= =	<u> </u>
CA_4A-12A				Yes	Yes			Yes	Yes	30	1
CA_4A-12A 12 Yes Yes Yes 30 2 4 Yes Yes Yes 20 3 12 Yes Yes Yes Yes Yes 4 Yes Yes Yes Yes Yes 12 Yes Yes Yes Yes Yes Yes 12 Yes Yes Yes Yes Yes Yes Yes 12 Yes Yes Yes Yes Yes Yes Yes Yes 12 Yes										50	'
CA_4A-12A CA_4A-12A 12 Yes								Yes	Yes	30	2
4	CA 4A-12A	CΔ ΛΛ ₋ 12Λ			Yes		Yes			30	
12	OΛ_ 1 Λ-12Λ	∪∩_ 1 Λ-12Λ	4			Yes	Yes			20	2
12 Yes Yes 30 4 4 Yes Yes 20 5 12 Yes 20 5 CA_4A-4A- 4 See CA_4A-4A Bandwidth Combination 50 0			12			Yes	Yes			<u></u>	s
12 Yes Yes 30 4 4 Yes Yes 20 5 12 Yes 20 5 CA_4A-4A- 4 See CA_4A-4A Bandwidth Combination 50 0			4			Yes	Yes	Yes	Yes	20	4
4 Yes Yes Yes 20 5 12 Yes Yes 20 5 CA_4A-4A- 4 See CA_4A-4A Bandwidth Combination										30	4
12 Yes 20 5 CA_4A-4A- 4 See CA_4A-4A Bandwidth Combination 50 0								Yes			_
CA_4A-4A- 4 See CA_4A-4A Bandwidth Combination 50 0										20	5
	CA 4A-4A-			See	CA 4A-		dwidth	Combin	nation		_
		-								50	0

	I	40		1				1		1
		12			Yes	Yes				
		4			Yes	Yes	Yes	Yes		
CA_4A-12B	-	12	See				Combina	ation	35	0
				Set	0 in Tal	ole 5.6 <i>P</i>	\.1-1			
		4			Yes	Yes	Yes	Yes	20	0
04 44 404	04 44 404	13				Yes			30	U
CA_4A-13A	CA_4A-13A	4			Yes	Yes				
		13				Yes			20	1
			Cook		4 A D a ia		Camabin	-4:		
CA_4A-4A-		4	See				Combir	ation	50	_
_ 13A	-	40		Set	0 in Tal		1.1-3	ı	50	0
		13				Yes				
CA_4A-17A	CA_4A-17A	4			Yes	Yes			20	0
O/(_ + /(1//(O/(_4/(1//(17			Yes	Yes			20	U
04 44 074		4			Yes	Yes	Yes	Yes	00	•
CA_4A-27A	-	27		Yes	Yes	Yes			30	0
		4			Yes	Yes	Yes	Yes		
CA_4A-28A	-	28			Yes	Yes	Yes	Yes	40	0
							165	162		
		4			Yes	Yes			20	0
		29		Yes	Yes	Yes			-	-
CA_4A-29A	_	4			Yes	Yes			20	1
UA_4A-29A	_	29			Yes	Yes			20	'
		4			Yes	Yes	Yes	Yes		_
		29			Yes	Yes			30	2
		4	800				combin	otion		
CA_4A-4A-		4	366					alion	F O	
29A	-	- 20		Set	0 in Tab		1.1-3	l	50	0
		29			Yes	Yes				
CA_4A-30A	_	4			Yes	Yes	Yes	Yes	30	0
O/1_4/1 00/1		30			Yes	Yes			30	U
CA 4A 4A		4	See	CA_4A	-4A Bar	ndwidth	combin	ation		
CA_4A-4A-	-			set	0 in Tab	ole 5.6A	۱.1-3		50	0
30A		30			Yes	Yes				
		4			Yes	Yes	Yes	Yes		
CA_4A-46A	-	46			100	100	100	Yes	40	0
			\/	\/	\/	\/		169		
		5	Yes	Yes	Yes	Yes			30	0
CA_5A-7A	CA_5A-7A	7				Yes	Yes	Yes		
Ort_ort //t	0/1_0/1/11	5			Yes	Yes			30	1
		7				Yes	Yes	Yes	30	'
0	21 -1 121	5			Yes	Yes				_
CA_5A-12A	CA_5A-12A	12			Yes	Yes			20	0
		5			Yes	Yes				
CA_5A-12B		12	800	CA 13			Combina	tion	25	0
CA_SA-12B	-	12	See					allon	25	0
		_	 	Set	0 in Tal		1. I-T	ı		
CA_5A-13A	_	5	 		Yes	Yes	!		20	0
		13				Yes			_ - •	_
CA_5A-17A	CA 5A 47A	5	<u> </u>	<u> </u>	Yes	Yes	<u> </u>	<u> </u>	20	_
CA_SA-17A	CA_5A-17A	17			Yes	Yes			20	0
a ·		5			Yes	Yes				_
CA_5A-25A	-	25			Yes	Yes	Yes	Yes	30	0
		5	 		Yes	Yes	103	, 03		
CA_5A-29A	-		 				-		20	0
		29	<u> </u>		Yes	Yes				
CA_5A-30A	_	5			Yes	Yes			20	0
		30	<u> </u>	<u> </u>	Yes	Yes	<u> </u>	<u> </u>		
CA		5			Yes	Yes			20	
CA_5A-38A	_	38			Yes	Yes	Yes	Yes	30	0
		5			Yes	Yes				
		40	 		Yes	Yes	Yes	Yes	30	0
CA_5A-40A	-		-	Voc			169	162		
		5	<u> </u>	Yes	Yes	Yes	 , , 		30	1
		40			Yes	Yes	Yes	Yes		
		5	<u></u>		Yes	Yes	<u> </u>			
CA_5A-40C		40	See	CA_40	C Band	dwidth C	Combina	ation	50	0
UA_3A-40U	_	40	<u> </u>	Set	1 in Tal	ole 5.6A	\.1-1			
		5		Yes	Yes	Yes			50	1
<u> </u>					•		•			

		40	See	CA_40				ation		
				Set	1 in Tal	ole 5.6/	<u>\.1-1</u>			
		7				Yes	Yes	Yes	30	0
CA_7A-8A		8		Yes	Yes	Yes			30	U
OA_1 A-0A	_	7				Yes	Yes	Yes	30	1
		8			Yes	Yes			30	'
CA 7A 12A		7			Yes	Yes	Yes	Yes	20	0
CA_7A-12A	-	12			Yes	Yes			30	0
		7				Yes	Yes	Yes	00	_
		20			Yes	Yes			30	0
CA_7A-20A	CA_7A-20A	7				Yes	Yes	Yes		
		20			Yes	Yes	Yes	Yes	40	1
		7			103	Yes	Yes	Yes		
CA_7A-22A	-	22			Yes	Yes	Yes	Yes	40	0
		7			Yes	Yes	Yes	Yes	35	0
CA_7A-28A	CA_7A-28A	28			Yes	Yes	Yes			
		7			Yes	Yes	Yes	Yes	40	1
		28			Yes	Yes	Yes	Yes		'
		7	See C	CA_7B	pandwid	th com	binatior	n set 0		
CA_7B-28A	-	'		i	n table	5.6A.1-	1		40	0
		28			Yes	Yes	Yes	Yes		
		7	See C	CA_7C I	candwid	th com	binatior	n set 2		
CA_7C-28A	-			i	n table	5.6A.1-	1		60	0
		28			Yes	Yes	Yes	Yes		
04 74 404		7			Yes	Yes	Yes	Yes	4.0	
CA_7A-40A	-	40			Yes	Yes	Yes	Yes	40	0
		7			Yes	Yes	Yes	Yes		
CA_7A-40C	_		See	CA_40					60	0
O/1_//\ 100		40	000		1 in Tal			20011	00	
		7		001	Yes	Yes	Yes	Yes		
CA_7A-42A	-	42			Yes	Yes	Yes	Yes	40	0
			1							
CA_7A-42A-		7		0 0	Yes	Yes	Yes	Yes	00	
_42A	-	42	0-				ndwidth		60	0
			Col	mbinatio						
CA_7A-46A	_	7			Yes	Yes	Yes	Yes	40	0
		46						Yes		, and the second
CA_8A-11A	_	8			Yes	Yes			20	0
O/1_0/\ 11/\		11			Yes	Yes			20	· ·
		8			Yes	Yes			20	0
04 04 004		20			Yes	Yes			20	0
CA_8A-20A	-	8		Yes	Yes	Yes				
		20	1	1	Yes	Yes			20	1
		8		1	Yes	Yes	<u> </u>			
	-	40			Yes	Yes	Yes	Yes	30	0
CA_8A-40A		1		Voc			162	162		+
	-	8		Yes	Yes	Yes	\/a-	Vac	30	1
		40	1		Yes	Yes	Yes	Yes		1
CA_8A-41A		8	Yes	Yes	Yes	Yes	1	<u> </u>	30	0
		41				Yes		Yes		
		8	Yes	Yes	Yes	Yes				
CA_8A-41C	-	41	See 0	CA_41C	bandw	idth co	mbinatio	on set	50	0
		41		3	in table	5.6A.1	-1			
04 04 :-:		8	Yes	Yes	Yes	Yes				_
CA_8A-42A	-	42			Yes	Yes	Yes	Yes	30	0
		8	Yes	Yes	Yes	Yes		. 55		1
CA_8A-42C	_			CA_42			l Ombin	ation	50	0
J, , U, , TAU		42	366		0 in Tal			20011	50	
	L	11	1	361	Yes		\. 1*1	 		1
			1		Yes	Yes Yes	Yes		25	0
CA_11A-18A	-						1 4 60	1		I
	-	18					100	 		
CA_11A-18A	-	18 12			Yes	Yes			30	0
	-	18 12 25			Yes Yes	Yes Yes	Yes	Yes	30	0
CA_11A-18A	-	18 12			Yes	Yes		Yes	30	0

CA_18A-28A	CA_18A-28A	18			Yes	Yes	Yes		25	0
_	_	28 19			Yes Yes	Yes Yes	Yes			
CA_19A-21A	CA_19A-21A	21			Yes	Yes	Yes		30	0
		19			Yes	Yes	Yes			
CA_19A-28A	-	28			Yes	Yes	100		25	0
0.4 40.4 40.4		19			Yes	Yes	Yes		0.5	
CA_19A-42A	-	42			Yes	Yes	Yes	Yes	35	0
		19			Yes	Yes	Yes			
CA_19A-42C	-	42	See		2C Band 0 in Tal		Combina \.1-1	ation	55	0
04 004 044		20			Yes	Yes	Yes	Yes	0.5	0
CA_20A-31A	-	31		Yes	Yes				25	0
CA_20A-32A	_	20			Yes	Yes			30	0
OA_20A-32A	_	32			Yes	Yes	Yes	Yes	30	Ü
CA_20A-38A	-	20			Yes	Yes	Yes	Yes	40	0
		38			Yes	Yes	Yes	Yes	_	
CA_20A-40A	-	20 40			Yes	Yes	Yes	Yes	40	0
		20			Yes Yes	Yes Yes	Yes Yes	Yes Yes		
CA_20A-42A	-	42			Yes	Yes	Yes	Yes	40	0
		20			Yes	Yes	Yes	Yes		
CA_20A-42A-	-			See C			ndwidth		60	0
42A		42	Coı	mbination	on Set (in Tab	le 5.6A	1-3		
CA_20A-67A	_	20			Yes	Yes	Yes	Yes	40	0
071_2071 0771		67			Yes	Yes	Yes	Yes		Ů
CA_21A-42A	-	21 42			Yes	Yes	Yes	V	35	0
		21			Yes Yes	Yes Yes	Yes Yes	Yes		
CA_21A-42C	_		See	CA 42			Combina	ation	55	0
0/(_21//(120		42	000		0 in Tal			ation	00	Ŭ
		23			Yes	Yes	Yes	Yes	00	
CA 22A 20A		29		Yes	Yes	Yes			30	0
CA_23A-29A	-	23			Yes	Yes			20	4
		29		Yes	Yes	Yes			20	1
		25		Yes	Yes	Yes	Yes	Yes	35	0
		26	Yes	Yes	Yes	Yes	Yes			Ů
CA_25A-26A	-	25		Yes	Yes	Yes			20	1
_		26		Yes	Yes	Yes				
		25 26			Yes	Yes			20	2
		25			Yes Yes	Yes Yes	Yes	Yes		
CA_25A-41A ⁶	-	41			Yes	Yes	Yes	Yes	40	0
		25			Yes	Yes	Yes	Yes		
CA_25A-41C ⁶	-		See	CA_41			Combina		60	0
		41			1 in Tal					
		25			Yes	Yes	Yes	Yes		
CA_25A-41D ⁶	-	41	See				Combina	ation	80	0
				Set	0 in Tal					
CA_26A-41A	-	26 41			Yes	Yes	Yes	Yes	35	0
		26			Yes Yes	Yes Yes	Yes Yes	162		
CA_26A-41C	_		See	CA 41			Combina	L ation	55	0
		41			1 in Tal					
CA 20A 40A		28			Yes	Yes	Yes	Yes	40	0
CA_28A-40A	-	40			Yes	Yes	Yes	Yes	40	U
		28			Yes	Yes	Yes	Yes		
CA_28A-40C	-	40	See C				mbinati	on set	60	0
				1	in Table			Vac		
CA_28A-40D	_	28	800	CA 40	Yes	Yes	Yes Combina	Yes	80	0
UA_20A-40D	_	40	See		טום Band 0 in Tal			auUH	00	
CA_28A-41A	-	28		301	Yes	Yes			30	0
	l .			1			<u> </u>	L		

		41			Yes	Yes	Yes	Yes		
		28			Yes	Yes	103	103		
CA_28A-41C		_	See C	A 41C			mbinati	on set	50	0
		41			in Table					
CA_28A-42A		28			Yes	Yes	Yes	Yes	40	0
CA_20A-42A	-	42			Yes	Yes	Yes	Yes	40	U
		28			Yes	Yes	Yes	Yes		
CA_28A-42C	-	42	See 0		in Table		mbinati -1	on set	60	0
CA_29A-30A	_	29			Yes	Yes			20	0
O/1_23/1 30/1		30			Yes	Yes			20	U U
CA_38A-40A	_	38				Yes		Yes	40	0
O/1_00/(+0/(40				Yes		Yes		Ŭ .
CA_38A-40A-		38				Yes		Yes		
40A	-	40	Co				ndwidth le 5.6A		60	0
		38				Yes		Yes		
CA_38A-40C	-	40	See		C Band 0 in Tal		Combina A.1-1		60	0
04 004 444	04 004 444	39				Yes	Yes	Yes	40	0
CA_39A-41A	CA_39A-41A	41		İ				Yes	40	0
	CA_41C	39				Yes	Yes	Yes		
CA_39A-41C	CA_39A-41A	41						Yes	60	0
	CA_39A-41C	41						Yes		
		39				Yes	Yes	Yes		
CA 20A 44D	CA_41C	41						Yes	00	0
CA_39A-41D	CA_39A-41A	41						Yes	80	0
		41						Yes		
	CA_39C	39	See	CA_39	C Band	dwidth (Combina	ation		
CA_39C-41A	CA_39A-41A			Set	0 in Tal	ole 5.6/	\.1-1		55	0
	CA_39C-41A	41		<u> </u>	<u> </u>			Yes		
	CA_39C	39	See				Combina	ation		
CA_39C-41C	CA_41C	44		Set	0 in Tal	ole 5.6 <i>F</i>	1.1-1	Vaa	75	0
_	CA_39A-41A	41						Yes		
		41				\/	\/	Yes		
CA_41A-42A	-	41 42			-	Yes	Yes	Yes Yes	40	0
		42		-	-	Yes Yes	Yes Yes	Yes		
00 440 400		41	_	04 17					60	_
CA_41A-42C	-	42	See				Combina	ation	60	0
		4.4			1 in Tal					
04 440 404		41	See	_			Combina	ation	00	0
CA_41C-42A	-	42		Set	0 in Tal	60	0			
		42				Yes	Yes	Yes		
		41	See		C Band 0 in Tal		Combina	ation		
CA_41C-42C	-	40							80	0
		42	See				Combina	ation	-	-
				Set	1 in Tal		\.1-1			
CA_41A-46A	_	41			Yes	Yes	Yes	Yes	40	0
JA_+1A-+0A	-	46			ļ		ļ	Yes	70	0
CA_42A-46A	_	42			Yes	Yes	Yes	Yes	40	0
UN_ 12/1 TO/1		46						Yes	10	

NOTE 1: The CA Configuration refers to a combination of an operating band and a CA bandwidth class specified in Table 5.6A-1 (the indexing letter). Absence of a CA bandwidth class for an operating band implies support of all classes.

NOTE 2: For each band combination, all combinations of indicated bandwidths belong to the set.

NOTE 3: For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal.

NOTE 4: Uplink CA configurations are the configurations supported by the present release of specifications.

NOTE 5: For TDD inter-band Carrier Aggregation only non-simultaneous Rx/Tx uplink CA configurations can be supported by UE supporting corresponding DL CA configuration without simultaneous Rx/Tx.

NOTE 6: For the corresponding CA configuration, UE may not support Pcell transmissions in this E-UTRA band.

Table 5.6A.1-2a: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA (three bands)

	E-U7	RA CA c	onfigur	ation /	Bandw	idth co	mbinati	on set		
E-UTRA CA Configuration	Uplink CA configurations (NOTE 5)	E- UTRA Bands	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Maximum aggregated bandwidth [MHz]	Bandwidth combination set
		1			Yes	Yes	Yes	Yes		
	CA_1A-3A	3			Yes	Yes	Yes	Yes	50	0
CA_1A-3A-5A	CA_1A-5A ⁶	5			Yes	Yes				
	CA_3A-5A	1			Yes	Yes		\/	40	4
		<u>3</u> 5			Yes Yes	Yes Yes	Yes	Yes	40	1
		1			Yes	Yes	Yes	Yes		
CA_1A-3A-7A	_	3			Yes	Yes	Yes	Yes	60	0
5/L		7			100	Yes	Yes	Yes		ŭ
		1			Yes	Yes	Yes	Yes		
CA 1A 2A 7C		3				Yes	Yes	Yes	80	0
CA_1A-3A-7C	-	7	See C		Bandwid n Table		bination 1	Set 2	00	U
		1			Yes	Yes	Yes	Yes		
		3			Yes	Yes	Yes	Yes	50	0
		8		Yes	Yes	Yes				
		1	ļ		Yes	Yes	, , -		4-	_
	CA_1A-3A	3			Yes	Yes	Yes	Yes	40	1
CA_1A-3A-8A	CA_1A-8A ⁶	8		Yes	Yes	Yes	Vaa			
_	CA_3A-8A ⁶	3			Yes Yes	Yes Yes	Yes Yes		40	2
		8		Yes	Yes	Yes	res		40	2
		1		165	Yes	Yes	Yes	Yes		
		3			Yes	Yes	Yes	Yes	50	3
		8			Yes	Yes	103	103	30	J
	CA_1A-3A	1			Yes	Yes	Yes	Yes		
CA_1A-3A-19A	CA_1A-19A ⁶	3			Yes	Yes	Yes	Yes	55	0
_	CA_3A-19A	19			Yes	Yes	Yes			
		1			Yes	Yes	Yes	Yes		
CA_1A-3A-26A	-	3			Yes	Yes	Yes	Yes	50	0
		26			Yes	Yes				
04 44 04 004		1			Yes	Yes	Yes	Yes		
CA_1A-3A-20A	-	3			Yes	Yes	Yes	Yes	60	0
		20			Yes	Yes	Yes	Yes		
CA_1A-3A-28A		3			Yes Yes	Yes Yes	Yes Yes	Yes Yes	60	0
CA_1A-3A-20A	_	28			Yes	Yes	Yes	Yes	00	U
		1			Yes	Yes	Yes	Yes		
CA_1A-3A-40A	_	3			Yes	Yes	Yes	Yes	60	0
<i>o,</i> <u>_</u> <i>o,</i>		40			Yes	Yes	Yes	Yes		· ·
		1			Yes	Yes	Yes	Yes		
CA_1A-3A-42A	-	3			Yes	Yes	Yes	Yes	60	0
		42			Yes	Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes		
CA_1A-3A-42C	-	3			Yes	Yes	Yes	Yes	80	0
		42	See		in Table		mbinatio			-
		1			Yes	Yes	Yes	Yes		
CA_1A-5A-40A	-	5			Yes	Yes			50	0
		40				Yes	Yes	Yes		
		1			Yes	Yes			40	_
	CA_1A-5A ⁶	5			Yes	Yes	<u></u>	\ <u>'</u>	40	0
CA_1A-5A-7A	CA_1A-7A	7	-		V-	Yes	Yes	Yes		
_ `	CA_5A-7A ⁶	1 5	 		Yes	Yes	Yes	Yes	E 0	4
		5 7	1		Yes	Yes Yes	Yes	Yes	50	1
		1	 		Yes	Yes	Yes	Yes		
CA_1A-7A-8A	-	7	<u> </u>		163	Yes	Yes	Yes	50	0
	1		L	<u> </u>	<u> </u>	163	169	163		

	1		1					ı	T	1
		8			Yes	Yes				
		1			Yes	Yes	Yes	Yes		
CA_1A-7A-20A	-	7				Yes	Yes	Yes	50	0
		20			Yes	Yes				
		1			Yes	Yes	Yes	Yes		
		7				Yes	Yes	Yes	55	0
CA 1A 7A 20A		28			Yes	Yes	Yes			
CA_1A-7A-28A	-	1			Yes	Yes	Yes	Yes		
		7				Yes	Yes	Yes	60	1
		28				Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes		
			See C	A 7C F			bination			
CA_1A-7C-28A	-	7			n Table				80	0
		28		<u></u>	i rabio	Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes		
CA_1A-8A-11A	_	8			Yes	Yes	163	163	40	0
CA_1A-0A-11A	_	11			Yes				40	
		1				Yes	Vaa	Vaa		
0.4.4.0.4.0.4					Yes	Yes	Yes	Yes	=0	
CA_1A-8A-40A	-	8		Yes	Yes	Yes			50	0
		40	ļ		Yes	Yes	Yes	Yes		
		1			Yes	Yes	Yes	Yes		
		11			Yes	Yes			45	0
CA_1A-11A-		18			Yes	Yes	Yes			
18A	-	1			Yes	Yes	Yes	Yes		
		11			Yes	Yes			40	1
		18			Yes	Yes				
		1			Yes	Yes	Yes	Yes		
		18			Yes	Yes	Yes		45	0
CA_1A-18A-	CA_1A-18A ⁶	28			Yes	Yes			.0	
28A	CA_1A-28A	1			Yes	Yes	Yes	Yes		
20/1	CA_18A-28A	18			Yes	Yes	163	103	40	1
		28			Yes	Yes			40	'
	04 44 4046						Vaa	Yes		
CA_1A-19A-	CA_1A-19A ⁶	1			Yes	Yes	Yes	res	=0	
21A	CA_1A-21A	19			Yes	Yes	Yes		50	0
	CA_19A-21A ⁶	21			Yes	Yes	Yes			
CA 1A 10A		1			Yes	Yes	Yes	Yes		
CA_1A-19A- 28A	-	19			Yes	Yes	Yes		45	0
ZOA		28			Yes	Yes				
		1			Yes	Yes	Yes	Yes		
CA_1A-19A-	_	19			Yes	Yes	Yes		55	0
42A		42			Yes	Yes	Yes	Yes	00	
		1			Yes	Yes	Yes	Yes		
CA_1A-19A-	_	19			Yes	Yes	Yes		75	0
42C		42	See (mbinatio	on set		
				0	in Table			,		
CA 4A 04A		1		<u></u>	Yes	Yes	Yes	Yes		
CA_1A-21A-	-	21			Yes	Yes	Yes		55	0
42A		42			Yes	Yes	Yes	Yes		
		1		1	Yes	Yes	Yes	Yes		
CA_1A-21A-		21			Yes	Yes	Yes	100		
42C	-	21	Soot	CA 42C			mbinatio	on oot	75	0
420		42	See					JII SEL		
		2	1	I	in Table			Yes		1
04 04 14 -:			 	-	Yes	Yes	Yes		5 0	
CA_2A-4A-5A	-	4	ļ		Yes	Yes	Yes	Yes	50	0
		5			Yes	Yes				
		2	See				Combin	ation		
CA_2A-2A-4A-			<u></u>	Set	0 in Tal	ole <u>5</u> .6A	\.1-3		70	
_ 5A	_	4			Yes	Yes	Yes	Yes	70	0
		5			Yes	Yes				
		2			Yes	Yes	Yes	Yes		
CA_2A-4A-7A		4	 		Yes	Yes	Yes	Yes	60	0
UN_2N-4M-1M		7	1	-	Yes	Yes	Yes	Yes	00	
04 04 44 44			1	1					70	
CA_2A-4A-4A-	-	2		1	Yes	Yes	Yes	Yes	70	0

5A		4	See	CA_4A-4A Ba			ation		
			1	Set 0 in T		4.1-3	1		
		5		Yes	Yes		.,		
	CA_2A-4A	2		Yes	Yes	Yes	Yes		
CA_2A-4A-12A	CA_4A-12A	4		Yes	Yes	Yes	Yes	50	0
		12		Yes	Yes				
		2	See	CA_2A-2A Ba			ation		
CA_2A-2A-4A-	_			Set 0 in T				70	0
12A		4		Yes	Yes	Yes	Yes		
		12		Yes	Yes				
		2		Yes	Yes	Yes	Yes		
CA_2A-4A-4A-	_	4	See	CA_4A-4A Ba			ation	70	0
12A				Set 0 in T		4.1-3	1		
		12		Yes	Yes				
		2		Yes	Yes	Yes	Yes		
CA_2A-4A-13A	-	4		Yes	Yes	Yes	Yes	50	0
		13			Yes				
		2		Yes	Yes	Yes	Yes		
CA_2A-4A-29A	-	4		Yes	Yes	Yes	Yes	50	0
		29		Yes	Yes				
		2		Yes	Yes	Yes	Yes		
CA_2A-4A-30A	-	4		Yes	Yes	Yes	Yes	50	0
		30		Yes	Yes				
		2		Yes	Yes	Yes	Yes		
CA_2A-5A-12A	_	5		Yes	Yes	1.00		40	0
OA_2A-3A-12A	_	12		Yes	Yes			0	
		2	800	CA_2A-2A Ba		Combin	otion		
CA_2A-2A-5A-			See	Set 0 in T			iation		
12A	-	5		Yes	Yes	1.1-5		60	0
12A		12		Yes	Yes				
		2		Yes	Yes	Yes	Yes		
		5		Yes	Yes	162	162	-	
CA_2A-5A-12B	-		0 (0-4	45	0
		12	See C	CA_12B Band	wiath Co le 5.6A.		on Set		
		2		Yes	Yes	Yes	Yes		
CA 2A EA 12A	CA 2A 12A6	5		Yes	Yes	169	162	40	0
CA_2A-5A-13A	CA_2A-13A ⁶			162	Yes			40	0
		13		\\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\		\/	V		
04 04 54 004		2		Yes	Yes	Yes	Yes		
CA_2A-5A-29A	-	5		Yes	Yes			40	0
		29		Yes	Yes				
		2		Yes	Yes	Yes	Yes		
CA_2A-5A-30A	-	5		Yes	Yes	1		40	0
		30		Yes	Yes				
		2	See C	CA_2C Bandy			set 0		
CA_2C-5A-30A	_				e 5.6A.1	-1		60	0
3/1_20 3/A-30/A	-	5		Yes	Yes	1			
		30		Yes	Yes				
		2		Yes	Yes	Yes	Yes		
CA_2A-7A-12A	-	7		Yes	Yes	Yes	Yes	50	0
		12		Yes	Yes				
OA OA 404		2		Yes	Yes	Yes	Yes		
CA_2A-12A-	-	12		Yes	Yes			40	0
30A		30		Yes	Yes			1	
		2	See 0	CA_2C Bandv		bination	set 0		
CA_2C-12A-					e 5.6A.1			00	
30A	-	12		Yes	Yes			60	0
		30		Yes	Yes			1	
		2		Yes	Yes	Yes	Yes		
CA_2A-29A-	_	29		Yes	Yes	1.55	. 55	40	0
30A		30		Yes	Yes	+		1 70	
CA_2C-29A-		2	See C	CA_2C Bandw		nhination	l n set ∩		
30A	-	_	000		e 5.6A.1		1 361 0	60	0
JUA		l	ı	iii Tabl	J J.U∧. I	1		l .	l .

		20	1	1	V	V	I	1	<u> </u>	
		29 30			Yes Yes	Yes Yes				
							Voc	Voc		
CA 2A 5A 40A		3			Yes	Yes	Yes	Yes	50	0
CA_3A-5A-40A	-	5 40			Yes	Yes Yes	Yes	Yes	50	0
		3			Yes	Yes	Yes	168		
		7			165	Yes	Yes		40	0
		8			Voc		165		40	U
CA_3A-7A-8A	-	3			Yes	Yes	Yes	Yes		
		7			Yes	Yes Yes	Yes		5 0	4
		8			Vaa		res	Yes	50	1
	21 21 -1				Yes	Yes	Vaa	Vaa		
CA 2A 7A 20A	CA_3A-7A	7			Yes	Yes	Yes	Yes Yes	60	0
CA_3A-7A-20A	CA_3A-20A CA_7A-20A ⁶	20			Voc	Yes	Yes		60	0
	UA_1A-20A	3			Yes	Yes	Yes	Yes		
04 04 74 004	CA_3A-7A	7			Yes	Yes	Yes	Yes	00	0
CA_3A-7A-28A	CA_7A-28A				Yes	Yes	Yes	Yes	60	0
		28			Yes	Yes	Yes	Yes		
		3	0 0		<u> </u>	Yes	Yes	Yes		
CA_3A-7C-28A	-	7	See C			Ith Com		Set 2	80	0
_		20		<u> </u>	n rabie T	5.6A.1-		\/		
		28	0 0	\		Yes	Yes	Yes		
		3	See C			Ith Com		Set 0		
CA_3C-7A-28A	-	7		"	Table	5.6A.1-		Voc	80	0
		28				Yes	Yes	Yes		
		3	C C	A 20 F	ا من مارد با	Yes	Yes	Yes		
		3	See C			Ith Com 5.6A.1-		i Set u		
CA_3C-7C-28A	_	7	See C			Ith Com		Set 2	100	0
CA_3C-7C-26A	-	,	366 0			5.6A.1-		1 061 2	100	U
		28		1	l	Yes	Yes	Yes		
		3			Yes	Yes	Yes	Yes		
CA_3A-7A-	_	7			100	Yes	Yes	Yes	60	0
38A ⁷		38			Yes	Yes	Yes	Yes	00	J
		3			Yes	Yes	Yes	Yes		
CA_3A-8A-40A	_	8		Yes	Yes	Yes	100	100	50	0
OA_0A-0A-40A	_	40		103	Yes	Yes	Yes	Yes	30	0
		3			Yes	Yes	Yes	Yes		
CA_3A-19A-	_	19			Yes	Yes	Yes	163	55	0
42A	-	42			Yes	Yes	Yes	Yes	55	U
		3			Yes	Yes	Yes	Yes		
CA_3A-19A-		19			Yes	Yes	Yes	162		
42C	-	19	S00 (^ 42C		res /idth cor		n oot	75	0
720		42	See			5.6A.1		JII SEL		
		3		Ι	Yes	Yes	Yes	Yes		
CA_3A-28A-	_	28			Yes	Yes	Yes	Yes	60	0
40A	_	40	<u> </u>		Yes	Yes	Yes	Yes	00	J
		3	 		Yes	Yes	Yes	Yes		
CA_3A-28A-		28	 		Yes	Yes	Yes	Yes		
40C	-		Sec	L Δ 400		res /idth cor			80	0
700		40	366 (5.6A.1		JII SEL		
		3	<u> </u>	l J	Yes	Yes	Yes	Yes		
CA_3A-41A-	_	41	 		163	Yes	Yes	Yes	60	0
42A	_	42	 			Yes	Yes	Yes	00	J
		4	 		Yes	Yes	Yes	Yes		
CA_4A-5A-12A	_	5	 		Yes	Yes	163	163	40	0
OA_+A-0A-12A	_	12	1		Yes	Yes			40	U
		4	800			dwidth	Combin	ation		
CA 4A 4A EA		4	See			iawiath ole 5.6A		auon		
CA_4A-4A-5A- 12A	-	5	 	Set	Yes	Yes	. 1-3		60	0
144		12	 		Yes	Yes				
		4	 		Yes	Yes	Yes	Yes		
CA_4A-5A-13A	CA_4A-13A ⁶	5	-				168	168	40	0
		5			Yes	Yes				

		13				Yes				
		4			Yes	Yes	Yes	Yes		
CA_4A-5A-29A	_	5			Yes	Yes			40	0
		29			Yes	Yes				
		4			Yes	Yes	Yes	Yes		
CA_4A-5A-30A	-	5			Yes	Yes			40	0
		30			Yes	Yes				
		4	See (CA 4A-			Combin	ation		
CA_4A-4A-5A-					0 in Tal				0.0	
30A	-	5			Yes	Yes			60	0
		30			Yes	Yes				
		4			Yes	Yes				
		7			Yes	Yes	Yes	Yes	40	0
00 40 70 400		12			Yes	Yes				
CA_4A-7A-12A	-	4			Yes	Yes	Yes	Yes		
		7			Yes	Yes	Yes	Yes	50	1
		12			Yes	Yes				
04 44 404		4			Yes	Yes	Yes	Yes		
CA_4A-12A-	-	12			Yes	Yes			40	0
30A		30			Yes	Yes				
		4	See (CA_4A-	-4A Ban	dwidth	Combin	ation		
CA_4A-4A-		Set 0 in Table 5.6A.1-3							60	
12A-30A	-	12 Yes Yes						60	0	
		30			Yes	Yes				
CA 4A 20A		4			Yes	Yes	Yes	Yes		
CA_4A-29A- 30A	-	29			Yes	Yes			40	0
30A		30			Yes	Yes				
		4	See				combin	ation		
CA_4A-4A-				set	0 in Tab		.1-3		60	0
29A-30A	-	29			Yes	Yes			00	
		30			Yes	Yes				
		7				Yes	Yes	Yes		
CA_7A-8A-20A	-	8		Yes	Yes	Yes			40	0
		20			Yes	Yes				
CA_7A-20A-		7				Yes	Yes	Yes		
38A ⁸	-	20			Yes	Yes	Yes	Yes	60	0
3071		38			Yes	Yes	Yes	Yes		
CA_19A-21A-		19			Yes	Yes	Yes			
42A	-	21			Yes	Yes	Yes		50	0
44/1		42			Yes	Yes	Yes	Yes		
		19			Yes	Yes	Yes			
CA_19A-21A-	-	21			Yes	Yes	Yes		70	0
42C	-	42	See C		Bandw in Table		mbinatio	on set	et 70	0

- NOTE 1: The CA Configuration refers to a combination of an operating band and a CA bandwidth class specified in Table 5.6A-1 (the indexing letter). Absence of a CA bandwidth class for an operating band implies support of all classes.
- NOTE 2: For each band combination, all combinations of indicated bandwidths belong to the set.
- NOTE 3: For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal.
- NOTE 4: A terminal which supports a DL CA configuration shall support all the lower order fallback DL CA combinations and it shall support at least one bandwidth combination set for each of the constituent lower order DL combinations containing all the bandwidths specified within each specific combination set of the upper order DL combination.
- NOTE 5: Uplink CA configurations are the configurations supported by the present release of specifications.
- NOTE 6: If the UE supports any uplink CA configuration for corresponding downlink CA configuration it shall support this uplink CA configuration.
- NOTE 7: UL carrier shall be supported in Band 3 only. Power imbalance between downlink carriers on Band 7 and Band 38 is assumed to be within [6dB].
- NOTE 8: UL carrier shall be supported in Band 20 only. Power imbalance between downlink carriers on Band 7 and Band 38 is assumed to be within [6dB]

Table 5.6A.1-2b: E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA (four bands)

Configuration		E-U	TRA CA	configu	ration /	Bandw	idth co	nbinati	on set		
CA_1A-3A-5A- 40A		configurations	UTRA			MHz	MHz	MHz	MHz	aggregated bandwidth	Bandwidth combination set
40A											
40A		_						Yes	Yes	70	٥ .
CA_1A-3A-7A-8A A - 1	40A	_				Yes] /0	0
CA_1A-3A-7A-BA			40				Yes				
SA										_	
SA	CA_1A-3A-7A-	_				Yes				70	0
CA_1A-3A-7A-28A	8A							Yes	Yes] /0	
CA_1A-3A-7A- 28A - 7											
The color of the						Yes				_	
28		_								80	0
Table Tabl	28A									00	
CA_1A-3A-7C-28A 3 Yes <			28				Yes				
CA_1A-3A-70- 28A						Yes		Yes	Yes		
Table 5	CA 1A 2A 7C		3								
1 1 1 1 1 1 1 1 1 1		-	7	See (CA_7C I	Bandwid	th Com	bination	Set 2	100	0
CA_1A-3A-8A- 40A	20A		7		i	n Table	5.6A.1-	1			
CA_1A-3A-8A- 40A			28				Yes	Yes	Yes	1	
Total Tota						Yes					
Total Tota	CA 1A-3A-8A-		3					Yes			
CA_1A-3A- 19A-42A - 3		-			Yes					70	0
CA_1A-3A-19A-42A	-							Yes	Yes	1	
CA_1A-3A- 19A-42A											
19A-42A	CA 1A-3A-										_
CA_1A-3A-19A-21A-42C		-								75	0
1	10/11/2/1								Yes	†	
CA_1A-3A-19A-42C - 3 Yes Yes Yes Yes Yes 95 0 42 See CA_42C Bandwidth combination set 0 in Table 5.6A.1-1 1 Yes											
19										1	
See CA_42C Bandwidth combination set 0 in Table 5.6A.1-1		_							162	95	0
CA_1A-19A- 21A-42A - 19	19A-42C	_	19	S00 (N 42C				s cot 0	95	0
CA_1A-19A-21A-42A - 19 Yes			42	366 (1 561 0		
CA_1A-19A- 21A-42A - 19 Yes Yes Yes 70 0 CA_1A-42A 21 Yes			1		<u> </u>				Vac		
21	CA 1A-19A-								103	1	
CA_1A-19A- 21A-42C - 11		-								70	0
CA_1A-19A- 21A-42C - 19 21 Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes <	Z1A- 1 ZA								Voc	}	
CA_1A-19A-21A-42C - 19 Yes Yes Yes 90 0 42 See CA_42C Bandwidth combination set 0 in Table 5.6A.1-1 2 Yes											
CA_1A-19A- 21A-42C - 21 Yes Yes Yes 90 0 42 See CA_42C Bandwidth combination set 0 in Table 5.6A.1-1 2 Yes									165	1	
See CA_42C Bandwidth combination set 0 in Table 5.6A.1-1	CA_1A-19A-									00	0
CA_2A-4A-5A- 12A -		-	21	C (A 400				+0	90	0
CA_2A-4A-5A- 12A -			42	See C					set u		
CA_2A-4A-5A-12A - 4 Yes Yes Yes Yes 960 0 CA_2A-4A-5A-29A - 2 Yes Yes <td></td> <td></td> <td>2</td> <td></td> <td><u> </u></td> <td></td> <td></td> <td></td> <td>Voc</td> <td></td> <td></td>			2		<u> </u>				Voc		
12A	CA 2A 4A 5A									<u> </u>	
12A 5 Yes Yes Yes 12 Yes Yes Yes Yes CA_2A-4A-5A-29A - 4 Yes Yes Yes CA_2A-4A-5A-30A - 4 Yes Yes Yes CA_2A-4A-5A-30A - 4 Yes Yes Yes CA_2A-4A-7A-12A-30A - 4 Yes Yes Yes CA_2A-4A-12A-30A - 4 Yes Yes Yes CA_2A-4A-12A-30A - 4 Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes <		-			-			res	res	60	0
CA_2A-4A-5A-29A - 2 Yes	12A				 					{	
CA_2A-4A-5A-29A - 4 Yes					 			V	V		
29A 5 Yes Yes 60 29 Yes Yes Yes 2 Yes Yes Yes Yes 2 Yes Yes Yes Yes 30A Yes Yes Yes 30 Yes Yes Yes 2 Yes Yes Yes Yes 2 Yes Yes Yes Yes 4 Yes Yes Yes Yes 12 Yes Yes Yes Yes	04 04 44 54				 					-	
29		-			-			res	res	60	0
CA_2A-4A-5A-30A - 2 Yes	29A									{	
CA_2A-4A-5A-30A - 4 Yes											
30A	04 04 44 = 1									-	
S		-						Yes	Yes	60	0
CA_2A-4A-7A- 12A -	30A									-	
CA_2A-4A-7A- 12A -					ļ						
12A 7 Yes Yes Yes Yes 10 0 0 12 Yes Yes Yes Yes 12 Yes Yes Yes Yes 12 Yes Yes Yes Yes Yes Yes 12 Yes											
7 Yes Yes Yes Yes 12 Yes Yes Yes CA_2A-4A- 12A-30A - 4 Yes Yes Yes Yes 4 Yes Yes Yes Yes 60 0		_								70	0
CA_2A-4A- 12A-30A - <u>4 Yes Yes Yes Yes</u> 60 0	12A							Yes	Yes		
CA_2A-4A- 12A-30A - 4 Yes Yes Yes Yes 60 0											
12A-30A - 4 Yes Yes Yes Yes 60 0	CA 24-14-									ļ	
12 Yes Yes		-						Yes	Yes	60	0
	12A-00A		12		<u> </u>	Yes	Yes	<u> </u>			

		30		Yes	Yes				
		2		Yes	Yes	Yes	Yes		
CA_2A-4A-		4		Yes	Yes	Yes	Yes	60	0
29A-30A	-	29		Yes	Yes			60	U
		30		Yes	Yes				

- NOTE 1: The CA Configuration refers to a combination of an operating band and a CA bandwidth class specified in Table 5.6A-1 (the indexing letter). Absence of a CA bandwidth class for an operating band implies support of all classes.
- NOTE 2: For each band combination, all combinations of indicated bandwidths belong to the set.
- NOTE 3: For the supported CC bandwidth combinations, the CC downlink and uplink bandwidths are equal.
- NOTE 4: A terminal which supports a DL CA configuration shall support all the lower order fallback DL CA combinations and it shall support at least one bandwidth combination set for each of the constituent lower order DL combinations containing all the bandwidths specified within each specific combination set of the upper order DL combination.
- NOTE 5: Uplink CA configurations are the configurations supported by the present release of specifications.

Table 5.6A.1-3: E-UTRA CA configurations and bandwidth combination sets defined for non-contiguous intra-band CA (with two sub-blocks)

					th combinatio	n set	1
		Componer		rder of increas iency	sing carrier	Maximum	
E-UTRACA	Uplink CA configurations	Channel	Channel	Channel	Channel	aggregated	Bandwidth combination
configuration	(NOTE 1)	bandwidths for carrier [MHz]	bandwidths for carrier [MHz]	bandwidths for carrier [MHz]	bandwidths for carrier [MHz]	bandwidth [MHz]	set
CA_2A-2A	-	5, 10, 15, 20	5, 10, 15, 20			40	0
		5, 10, 15, 20	5, 10, 15, 20			40	0
CA_3A-3A	-	5, 10	5, 10, 15, 20			30	1
CA 4A 4A	CA 4A 4A	5, 10, 15, 20	5, 10, 15, 20			40	0
CA_4A-4A	CA_4A-4A	5, 10	5, 10			20	1
CA_5A-5A	-	5,10	5,10			20	0
		5	15				
		10	10, 15			40	0
CA_7A-7A -	-	15	15, 20			10	Ŭ
		20	20				
		5, 10, 15, 20	5, 10, 15, 20			40	1
CA_23A-23A	-	5	10			15	0
CA_25A-25A	_	5, 10	5, 10			20	0
UA_23A-23A	-	5, 10, 15, 20	5, 10, 15, 20			40	1
CA_40A-40A	-	10, 20	10, 20			40	0
CA_41A-41A	-	10, 15, 20 5, 10, 15,	10, 15, 20 5, 10, 15,			40	0
		20	20			40	1
CA_41A-41C	_	5, 10, 15, 20	L Complication Set Lin Table 1			60	0
0A_41A-410	-		C Bandwidth Set 1 in Table A.1-1	5, 10, 15, 20		00	
		5, 10, 15, 20		Bandwidth Cor in Table 5.6A.1			
CA_41A-41D	CA_41C	See CA_41D 0	Bandwidth Coi in Table 5.6A.1	mbination Set -1	5, 10, 15, 20	80	0
CA_41C-41C	CA_41C		C Bandwidth Set 0 in Table A.1-1		C Bandwidth Set 0 in Table A.1-1	80	0
CA_42A-42A	-	5, 10, 15, 20	5, 10, 15, 20			40	0
0.4.61.400		5, 10, 15, 20	See CA_420 Combination	C Bandwidth Set 0 in Table A.1-1		60	0
CA_42A-42C	-		C Bandwidth Set 0 in Table	5, 10, 15, 20			
		5, 10, 15, 20	See CA_42D	Bandwidth Cor in Table 5.6A.1		80	0
CA_42A-42D	-	See CA_42D	Bandwidth Coi in Table 5.6A.1	mbination Set	5, 10, 15, 20		
CA_42C-42C	-		C Bandwidth		C Bandwidth	80	0

		Combination S	Set 0 in Table	Combination S	Set 0 in Table		
		5.6A.1-1		5.6A.1-1			
CA_66A-66A	-	5, 10, 15, 20	5, 10, 15, 20			40	0
NOTE 1: Uplin	k CA configuration	s are the config	jurations suppo	rted by the pres	ent release of	specifications.	

5.6B Channel bandwidth for UL-MIMO

The requirements specified in subclause 5.6 are applicable to UE supporting UL-MIMO.

5.6B.1 Void

5.6C Channel bandwidth for Dual Connectivity

For E-UTRA DC bands specified in 5.5C, the corresponding E-UTRA CA configurations in 5.6A.1, i.e., dual uplink inter-band carrier aggregation with uplink assigned to two E-UTRA bands, are applicable to Dual Connectivity.

- NOTE 1: Requirements for the dual connectivity configurations are defined in the section corresponding E-UTRA uplink CA configurations, unless otherwise specified.
- NOTE 2: For TDD inter-band dual connectivity configurations, requirements are applicable only for synchronous operation.

5.6C.1 Void

Table 5.6C.1-1: Void

Table 5.6C.1-2: Void

5.6D Channel bandwidth for ProSe

5.6D.1 Channel bandwidths per operating band for ProSe

The ProSe combination of channel bandwidths and operating bands is shown in Table 5.6D.1-1 and Table 5.6D.1-2. The transmission bandwidth configuration in Table 5.6D.1-1 and Table 5.6D.1-2 shall be supported for each of the specified channel bandwidths. The same (symmetrical) channel bandwidth is specified for both the TX and RX path.

Table 5.6D.1-1 ProSe Direct Discovery channel bandwidth

	E-UTR	A ProSe ba	nd / ProSe o	hannel band	dwidth	
E-UTRA ProSe Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
2			Yes	Yes	Yes	Yes
3			Yes	Yes	Yes	Yes
4			Yes	Yes	Yes	Yes
7			Yes	Yes	Yes	Yes
14			Yes	Yes		
20			Yes	Yes	Yes	Yes
26			Yes	Yes	Yes	
28			Yes	Yes	Yes	Yes
31		•	Yes			
41		•	Yes	Yes	Yes	Yes
68			Yes	Yes	Yes	

Table 5.6D.1-2 ProSe Direct Communication channel bandwidth

	E-UTRA ProSe band / ProSe channel bandwidth											
E-UTRA ProSe Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz						
3				Yes								
7				Yes								
14				Yes								
20				Yes								
26				Yes								
28				Yes								
31			Yes									
68			Yes	Yes								

5.6F Channel bandwidth for category NB1

Channel bandwidth for Category NB1 is 200 kHz.

For category NB1, requirements in present document are specified for the channel bandwidth listed in Table 5.6F-1.

Table 5.6F-1: Transmission bandwidth configuration N_{RB} , $N_{tone\ 15kHz}$ and $N_{tone\ 3.75kHz}$ in NB1 channel bandwidth

Channel bandwidth BW _{Channel} [kHz]	200
Transmission bandwidth configuration <i>N</i> _{RB}	1
Transmission bandwidth configuration N _{tone 15kHz}	12
Transmission bandwidth configuration N _{tone} 3.75kHz	48

Figure 5.6F-1 shows the relation between the Category NB1 channel bandwidth (BW_{Channel}) and the Category NB1 transmission bandwidth configuration (N_{tone}). The channel edges are defined as the lowest and highest frequencies of the carrier separated by the channel bandwidth, i.e. at F_C +/- BW_{Channel}/2.

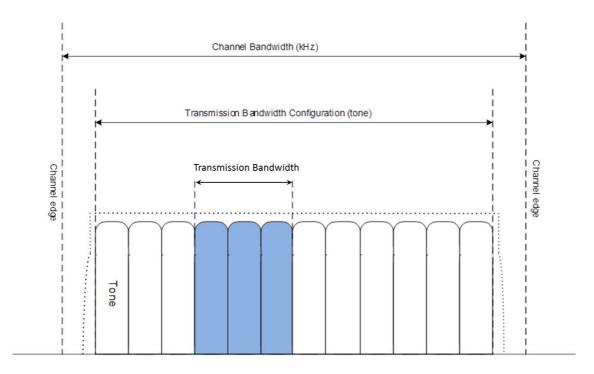


Figure 5.6F-1 Definition of Channel Bandwidth and Transmission Bandwidth configuration

5.7 Channel arrangement

5.7.1 Channel spacing

The spacing between carriers will depend on the deployment scenario, the size of the frequency block available and the channel bandwidths. The nominal channel spacing between two adjacent E-UTRA carriers is defined as following:

Nominal Channel spacing =
$$(BW_{Channel(1)} + BW_{Channel(2)})/2$$

where $BW_{Channel(1)}$ and $BW_{Channel(2)}$ are the channel bandwidths of the two respective E-UTRA carriers. The channel spacing can be adjusted to optimize performance in a particular deployment scenario.

5.7.1A Channel spacing for CA

For intra-band contiguous carrier aggregation with two or more component carriers, the nominal channel spacing between two adjacent E-UTRA component carriers is defined as the following unless stated otherwise:

where $BW_{Channel(1)}$ and $BW_{Channel(2)}$ are the channel bandwidths of the two respective E-UTRA component carriers according to Table 5.6-1 with values in MHz. The channel spacing for intra-band contiguous carrier aggregation can be adjusted to any multiple of 300 kHz less than the nominal channel spacing to optimize performance in a particular deployment scenario.

For intra-band contiguous carrier aggregation with two or more component carriers in Band 46, the requirements apply for both 19.8 MHz and 20.1 MHz nominal carrier spacing.

For intra-band non-contiguous carrier aggregation the channel spacing between two E-UTRA component carriers in different sub-blocks shall be larger than the nominal channel spacing defined in this subclause.

5.7.1F Channel spacing for category NB1

Nominal channel spacing for UE category NB1 in stand-alone mode is 200 kHz. For in-band and guard-band cases the nominal channel spacing between two adjacent category NB1 carriers is 180 kHz.

5.7.2 Channel raster

The channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple of 100 kHz.

5.7.2A Channel raster for CA

For carrier aggregation the channel raster is 100 kHz for all bands, which means that the carrier centre frequency must be an integer multiple of 100 kHz.

5.7.2F Channel raster for category NB1

Channel raster for category NB1 in-band, guard-band and standalone operation is 100 kHz.

5.7.3 Carrier frequency and EARFCN

The carrier frequency in the uplink and downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0-262143. The relation between EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where F_{DL_low} and $N_{Offs-DL}$ are given in Table 5.7.3-1 and N_{DL} is the downlink EARFCN.

$$F_{DL} = F_{DL_low} + 0.1(N_{DL} - N_{Offs-DL})$$

The relation between EARFCN and the carrier frequency in MHz for the uplink is given by the following equation where F_{UL_low} and $N_{Offs-UL}$ are given in Table 5.7.3-1 and N_{UL} is the uplink EARFCN.

$$F_{UL} = F_{UL_low} + 0.1(N_{UL} - N_{Offs\text{-}UL})$$

Table 5.7.3-1: E-UTRA channel numbers

E-UTRA		Downlink		Uplink		
Operating Band	F _{DL_low} (MHz)	Noffs-DL	Range of N _{DL}	F _{UL_low} (MHz)	Noffs-UL	Range of NuL
1	2110	0	0 – 599	1920	18000	18000 – 18599
2	1930	600	600 – 1199	1850	18600	18600 – 19199
3	1805	1200	1200 - 1949	1710	19200	19200 - 19949
4	2110	1950	1950 – 2399	1710	19950	19950 - 20399
5	869	2400	2400 - 2649	824	20400	20400 - 20649
6	875	2650	2650 - 2749	830	20650	20650 - 20749
7	2620	2750	2750 – 3449	2500	20750	20750 - 21449
8	925	3450	3450 - 3799	880	21450	21450 - 21799
9	1844.9	3800	3800 – 4149	1749.9	21800	21800 – 22149
10	2110	4150	4150 – 4749	1710	22150	22150 - 22749
11	1475.9	4750	4750 – 4949	1427.9	22750	22750 - 22949
12	729	5010	5010 - 5179	699	23010	23010 - 23179
13	746	5180	5180 - 5279	777	23180	23180 – 23279
14	758	5280	5280 – 5379	788	23280	23280 – 23379
17	734	5730	5730 – 5849	704	23730	23730 – 23849
18	860	5850	5850 - 5999	815	23850	23850 - 23999
19	875	6000	6000 - 6149	830	24000	24000 - 24149
20	791	6150	6150 - 6449	832	24150	24150 - 24449
21	1495.9	6450	6450 - 6599	1447.9	24450	24450 - 24599
22	3510	6600	6600 - 7399	3410	24600	24600 - 25399
23	2180	7500	7500 – 7699	2000	25500	25500 - 25699
24	1525	7700	7700 – 8039	1626.5	25700	25700 - 26039
25	1930	8040	8040 - 8689	1850	26040	26040 - 26689
26	859	8690	8690 - 9039	814	26690	26690 - 27039
27	852	9040	9040 – 9209	807	27040	27040 – 27209
28	758	9210	9210 – 9659	703	27210	27210 – 27659
29 ²	717	9660	9660 – 9769		N/A	
30	2350	9770	9770 – 9869	2305	27660	27660 – 27759
31	462.5	9870	9870 – 9919	452.5	27760	27760 – 27809
32 ²	1452	9920	9920 – 10359		N/A	1
33	1900	36000	36000 – 36199	1900	36000	36000 – 36199
34	2010	36200	36200 - 36349	2010	36200	36200 – 36349
35	1850	36350	36350 - 36949	1850	36350	36350 - 36949
36	1930	36950	36950 – 37549	1930	36950	36950 – 37549
37	1910	37550	37550 – 37749	1910	37550	37550 – 37749
38	2570	37750	37750 – 38249	2570	37750	37750 – 38249
39	1880	38250	38250 - 38649	1880	38250	38250 - 38649
40	2300	38650	38650 - 39649	2300	38650	38650 - 39649
41	2496	39650	39650 -41589	2496	39650	39650 -41589
42	3400	41590	41590 – 43589	3400	41590	41590 – 43589
43	3600	43590	43590 – 45589	3600	43590	43590 – 45589
44	703	45590	45590 – 46589	703	45590	45590 – 46589 46500 – 46780
45 46 ⁴	1447 5150	46590 46790	46590 – 46789 46790 – 54539	1447 5150	46590 46790	46590 – 46789 46790 – 54539
	3130	TO 1 30	40100 - 04009	3130	70730	70790 - 04309
64			Rese	rved		
65	2110	65536	65536 - 66435	1920	131072	131072 – 131971
66 ⁵	2110	66436	66436 - 67335	1710	131972	131972 – 132671
67 ²	738	67336	67336 – 67535		N/A	
68 NOTE 1: T	753	67536	67536 - 67835	698	132672	132672 - 132971

NOTE 1: The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.

NOTE 2: Restricted to E-UTRA operation when carrier aggregation is configured.

NOTE 3: For ProSe the corresponding UL channel number are also specified for the DL for the associated ProSe operating bands i.e. ProSe_FuL = FuL and ProSe_FpL = FuL.

NOTE 4: Requirements for uplink operations are not specified in this version of the specification.

NOTE 5: The range 2180-2200 MHz of the DL operating band is restricted to E-UTRA operation when carrier

aggregation is configured.

5.7.3F Carrier frequency and EARFCN for category NB1

The carrier frequency of category NB1 in the downlink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0-262143 and the Offset of category NB1 Channel Number to EARFCN in the range $\{-10,-9,-8,-7,-6,-5,-4,-3,-2,-1,-0.5,0,1,2,3,4,5,6,7,8,9\}$. The relation between EARFCN, Offset of category NB1 Channel Number to EARFCN and the carrier frequency in MHz for the downlink is given by the following equation, where F_{DL} is the downlink carrier frequency of category NB1, F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} is the downlink EARFCN, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} and F_{DL_low} are given in table 5.7.3-1, F_{DL_low} are given in table 5.7.3-1, F_{DL_low} and F_{DL_low} are given in table

$$F_{DL} = F_{DL_low} + 0.1(N_{DL} - N_{Offs\text{-}DL}) + 0.0025*(2M_{DL} + 1)$$

The carrier frequency of category NB1 in the uplink is designated by the E-UTRA Absolute Radio Frequency Channel Number (EARFCN) in the range 0-262143 and the Offset of category NB1 Channel Number to EARFCN in the range $\{-10,-9,-8,-7,-6,-5,-4,-3,-2,-1,0,1,2,3,4,5,6,7,8,9\}$. The relation between EARFCN, Offset of category NB1 Channel Number to EARFCN and the carrier frequency in MHz for the uplink is given by the following equation, where F_{UL} is the uplink carrier frequency of category NB1, F_{UL_low} and $N_{Offs-UL}$ are given in table 5.7.3-1, N_{UL} is the uplink EARFCN, M_{UL} is the Offset of category NB1 Channel Number to uplink EARFCN.

$$F_{UL} = F_{UL_low} + 0.1(N_{UL} - N_{Offs\text{-}UL}) + 0.0025*(2M_{UL})$$

- NOTE 1: For category NB1, N_{DL} or N_{UL} is different than the value of EARFCN that corresponds to E-UTRA downlink or uplink carrier frequency for in-band and guard band operation.
- NOTE 2: For stand-alone operation, only $M_{DL} = -0.5$ and $M_{UL} = 0$ are applicable. $M_{DL} = -0.5$ is not applicable for inband and guard band operation.
- NOTE 3: For the carrier including NPSS/NSSS for in-band and guard band operation, MDL is selected from {-2,-1,0,1}.

5.7.4 TX–RX frequency separation

a) The default E-UTRA TX channel (carrier centre frequency) to RX channel (carrier centre frequency) separation is specified in Table 5.7.4-1 for the TX and RX channel bandwidths defined in Table 5.6.1-1

Table 5.7.4-1: Default UE TX-RX frequency separation

E-UTRA Operating Band	TX – RX carrier centre frequency separation
1	190 MHz
2	80 MHz.
3	95 MHz.
4	400 MHz
5	45 MHz
6	45 MHz
7	120 MHz
8	45 MHz
9	95 MHz
10	400 MHz
11	48 MHz
12	30 MHz
13	-31 MHz
14	-30 MHz
17	30 MHz
18	45 MHz
19	45 MHz
20	-41 MHz
21	48 MHz
22	100 MHz
23	180 MHz
24	-101.5 MHz
25	80 MHz
26	45 MHz
27	45 MHz
28	55 MHz
30	45 MHz
31	10 MHz
65	190 MHz
66	400 MHz
68	55 MHz

b) The use of other TX channel to RX channel carrier centre frequency separation is not precluded and is intended to form part of a later release.

5.7.4A TX-RX frequency separation for CA

For intra-band contiguous carrier aggregation, the same TX-RX frequency separation as specified in Table 5.7.4-1 is applied to PCC and SCC, respectively.

5.7.4E TX-RX frequency separation for category M1

For the category M1 TX-RX frequency separation is flexible within the assigned channel bandwidth of E-UTRA carrier with the TX-RX frequency separation of the E-UTRA carriers as specified in Table 5.7.4-1.

5.7.4F TX-RX frequency separation for category NB1

For in-band and guard-band operation mode, the category NB1 TX-RX frequency separation is flexible within the assigned channel bandwidth of E-UTRA carrier with the TX-RX frequency separation of the E-UTRA carriers as specified in Table 5.7.4-1. For stand-alone operation mode the TX-RX frequency separation is the same as Table 5.7.4-1.

6 Transmitter characteristics

6.1 General

Unless otherwise stated, the transmitter characteristics are specified at the antenna connector of the UE with a single or multiple transmit antenna(s). For UE with integral antenna only, a reference antenna with a gain of 0 dBi is assumed.

6.2 Transmit power

6.2.1 Void

6.2.2 UE maximum output power

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth for non CA configuration unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

Table 6.2.2-1: UE Power Class

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1					23	±2		
2					23	±2 ²		
3					23	±2 ²		
4					23	±2		
5					23	±2		
6					23	±2		
7					23	±2 ²		
8					23	±2 ²		
9					23	±2		
10					23	±2		
11					23	±2		
12					23	±2 ²		
13					23	±2		
14	31	+2/-3			23	±2		
	0.	. 2, 0						
17					23	±2		
18					23	±2 ⁵		
19					23	±2		
20					23	±2 ²		
21					23	±2		
22					23	+2/-3.5 ²		
23					23 ⁶			
24					23	±2 ⁶ ±2		
						±2 ±2 ²		
25					23	±2 ²		
26					23			
27					23	±2		
28					23	+2/-2.5		
30					23	±2		
31					23	±2		
33					23	±2		
34					23	±2		
35					23	±2		
36					23	±2		
37					23	±2		
38					23	±2		
39					23	±2		
40					23	±2		
41					23	±2 ²		
42					23	+2/-3		
43					23	+2/-3		
44					23	+2/[-3]		
45					23	±2		
65					23	±2		
66					23	±2		
68					23	±2		

- NOTE 2: 2 refers to the transmission bandwidths (Figure 5.6-1) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} 4 MHz and F_{UL_high}, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB
- NOTE 3: For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is FFS.
- NOTE 4: PPowerClass is the maximum UE power specified without taking into account the tolerance
- NOTE 5: For a UE that supports both Band 18 and Band 26, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB for transmission bandwidths confined within 815 MHz and 818 MHz.
- NOTE 6: When NS_20 is signalled, the total output power within 2000-2005 MHz shall be limited to 7 dBm.

The default power class for an operating band is Power Class 3 unless otherwise stated.

6.2.2A UE maximum output power for CA

The following UE Power Classes define the maximum output power for any transmission bandwidth within the aggregated channel bandwidth.

The maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1ms).

For inter-band carrier aggregation with one uplink component carrier assigned to one E-UTRA band the requirements in subclause 6.2.2 apply. For inter-band carrier aggregation with two uplink contiguous component carrier assigned to one E-UTRA band the requirements specified in Table 6.2.2A-1 apply for that band.

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, UE maximum output power shall be measured over all component carriers from different bands. If each band has separate antenna connectors, maximum output power is measured as the sum of maximum output power at each UE antenna connector. The maximum output power is specified in Table 6.2.2A-0.

Table 6.2.2A-0: UE Power Class for uplink interband CA (two bands)

E-UTRA CA Configuration	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
CA_1A-3A	,	` ,	. ,	, ,	23	+2/-3 ²	, ,	, ,
CA_1A-5A					23	+2/-3		
CA_1A-7A					23	+2/-32		
CA_1A-8A					23	+2/-32		
CA_1A-18A					23	+2/-35		
CA_1A-19A					23	+2/-3		
CA_1A-21A					23	+2/-3		
CA_1A-26A					23	+2/-32		
CA_1A-28A					23	+2/-3		
CA_1A-42A					23	+2/-3		
CA_2A-4A					23	+2/-32		
CA_2A-5A					23	+2/-32		
CA_2A-12A					23	+2/-32		
CA_2A-13A					23	+2/-32		
CA_3A-5A					23	+2/-32		
CA_3A-7A					23	+2/-32		
CA_3A-8A					23	+2/-32		
CA_3A-19A					23	+2/-32		
CA_3A-20A					23	+2/-32		
CA_3A-26A					23	+2/-32		
CA_4A-5A					23	+2/-3		
CA_4A-7A					23	+2/-32		
CA_4A-12A					23	+2/-32		
CA_4A-13A					23	+2/-3		
CA_4A-17A					23	+2/-3		
CA_5A-7A					23	+2/-3 ²		
CA_5A-12A					23	+2/-32		
CA_5A-17A					23	+2/-3		
CA_7A-20A					23	+2/-32		
CA_7A-28A					23	+2/-32		
CA_18A-28A					23	+2/-3		
CA_19A-21A					23	+2/-3		
CA 39A-41A					23	+2/-32		
CA_39A-41C					23	+2/-32		
CA_39C-41A					23	+2/-32		

- NOTE 2: ² refers to the transmission bandwidths (Figure 5.6-1) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} 4 MHz and F_{UL_high}, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dR
- NOTE 3: PPowerClass is the maximum UE power specified without taking into account the tolerance
- NOTE 4: For inter-band carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).
- NOTE 5: For a UE that supports both Band 18 and Band 26, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB for transmission bandwidths confined within 815 MHz and 818 MHz.

For intra-band contiguous carrier aggregation the maximum output power is specified in Table 6.2.2A-1.

Table 6.2.2A-1: CA UE Power Class for intraband contiguous CA

E-UTRA CA Configuration	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
CA_1C					23	+2/-2		
CA_3C					23	+2/-22		
CA_7C					23	+2/-22		
CA_8B					23	+2/-22		
CA_38C					23	+2/-2		
CA_39C					23	+2/-2		
CA_40C					23	+2/-2		
CA_41C					23	+2/-22		
CA_42C					23	+2/-3		

NOTE 2: If all transmitted resource blocks (Figure 5.6A-1) over all component carriers are confined within Fullow and Fullow + 4 MHz or/and Fullow - 4 MHz and Fullow, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB

NOTE 3: PPowerClass is the maximum UE power specified without taking into account the tolerance

NOTE 4: For intra-band contiguous carrier aggregation the maximum power requirement should apply to the total transmitted power over all component carriers (per UE).

For intra-band non-contiguous carrier aggregation with one uplink carrier on the PCC, the requirements in subclause 6.2.2 apply. For intra-band non-contiguous carrier aggregation with two uplink carriers the maximum output power is specified in Table 6.2.2A-2.

Table 6.2.2A-2: UE Power Class for intraband non-contiguous CA

E-UTRA (CA Class 1	Tolerance	Class 2	Tolerance	Class 3	Tolerance	Class 4	Tolerance	
Configurat	tion (dBm)	(dB)	(dBm)	(dB)	(dBm)	(dB)	(dBm)	(dB)	
CA_4A-4	·A				23	+2/-2			
NOTE 1:	NOTE 1: For transmission bandwidths (Figure 5.6-1) confined within F _{UL_low} and F _{UL_low} + 4 MHz or F _{UL_high} – 4 MHz and								
	Ful_high, the maxir	num output po	wer requirer	ment is relaxe	d by reduci	ng the lower tole	erance limit l	by 1.5 dB	
NOTE 2:	P _{PowerClass} is the m	naximum UE p	ower specifi	ed without tak	king into acc	count the tolerar	nce		
NOTE 3:	NOTE 3: For intra-band non-contiguous carrier aggregation the maximum power requirement should apply to the total								
1	transmitted power over all component carriers (per UE).								

6.2.2B UE maximum output power for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the maximum output power for any transmission bandwidth within the channel bandwidth is specified in Table 6.2.2B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. The period of measurement shall be at least one sub frame (1ms).

Table 6.2.2B-1: UE Power Class for UL-MIMO in closed loop spatial multiplexing scheme

EUTRA band	Class 1 (dBm)	Tolerance (dB)	Class 2 (dBm)	Tolerance (dB)	Class 3 (dBm)	Tolerance (dB)	Class 4 (dBm)	Tolerance (dB)
1					23	+2/-3		
2					23	+2/-32		
3					23	+2/-32		
4					23	+2/-3		
5					23	+2/-3		
6					23	+2/-3		
7					23	+2/-3 ²		
8					23	+2/-3 ²		
9					23	+2/-3		
10					23	+2/-3		
11					23	+2/-3		
12					23	+2/-32		
13					23	+2/-3		
14					23	+2/-3		
17					23	+2/-3		
18					23	+2/-3		
19					23	+2/-3		
20					23	+2/-32		
21					23	+2/-3		
22					23	+2/-4.5 ²		
23					23	+2/-3		
24					23	+2/-3		
25					23	+2/-3 ²		
26					23	+2/-3 ²		
27					23	+2/-3		
28					23	+2/[-3]		
30					23	+2/-3		
31					23	+2/-3		
					20	12/ 0		
33					23	+2/-3		
34					23	+2/-3		
35					23	+2/-3		
36					23	+2/-3		
37					23	+2/-3		
38	1	1		1	23	+2/-3		
39		+		-	23	+2/-3		
40					23	+2/-3		
41 42					23	+2/-32		
					23	+2/-4 +2/-4		
43					23			
44		 		 	23	+2/[-3]		
45				1	23	+2/-3		
				1	00	.0/.0		
65				1	23	+2/-3		
66					23	+2/-3		
68 NOTE 1:	<u> </u>			<u> </u>	23	+2/-3		

NOTE 2: 2 refers to the transmission bandwidths (Figure 5.6-1) confined within F_{UL_low} and F_{UL_low} + 4 MHz or F_{UL_high} - 4 MHz and F_{UL_high}, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB

NOTE 3: For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is FFS.

NOTE 4: PPowerClass is the maximum UE power specified without taking into account the tolerance

The default power class for an operating band is Power Class 3 unless otherwise stated.

Table 6.2.2B-2: UL-MIMO configuration in closed-loop spatial multiplexing scheme

Transmission mode	DCI format	Codebook Index
Mode 2	DCI format 4	Codebook index 0

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.2 apply.

6.2.2C Void

<reserved for future use>

6.2.2D UE maximum output power for ProSe

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the UE maximum output power shall be as specified in Table 6.2.2A-0 in subclause 6.2.2A for the corresponding inter-band aggregation with uplink assigned to two bands.

If UE is configured to operate on single E-UTRA ProSe sidelink band or E-UTRA uplink band specidied in Table 5.5D-1, the requirements in subclause 6.2.2 apply.

6.2.2E UE maximum output power for Category M1 UE

The following UE Power Classes define the maximum output power for any transmission bandwidth within the channel bandwidth for non CA configuration and UL-MIMO unless otherwise stated. The period of measurement shall be at least one sub frame (1ms).

Table 6.2.2E-1: UE Power Class

EUTRA	Class 3	Tolerance	Class 5	Tolerance				
band	(dBm)	(dB)	(dBm)	(dB)				
1	23	±2	20	±2				
2	23	±2 ²	20	±2 ²				
3	23	±2 ²	20	±2 ²				
4	23 ±2 20 ±2							
5	23	±2	20	±2				
7	23	±2 ²	20	±2 ²				
8	23	±2 ²	20	±2 ²				
11	23	±2	20	±2				
12	23	±2 ²	20	±2 ²				
13	23	±2	20	±2				
18	23	±2 ⁵	20	±2 ⁵				
19	23	±2	20	±2				
20	23	±2 ²	20	±2 ²				
21	23	±2	20	±2				
26	23	±2 ²	20	±2 ²				
27	23	±2	20	±2				
28	23	+2/-2.5	20	+2/-2.5				
31	23	±2	20	±2				
39	23	±2	20	±2				
41	23	±2 ²	20	±2 ²				
NOTE 1: NOTE 2:	5.6-1) confir or F _{UL_high} – output powe		_low and F _{UL_l} _{UL_high} , the ma t is relaxed b	_{ow} + 4 MHz aximum				
NOTE 3:	output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB For the UE which supports both Band 11 and Band 21 operating frequencies, the tolerance is FFS.							
NOTE 4: NOTE 5:	P _{PowerClass} is the maximum UE power specified without taking into account the tolerance For a UE that supports both Band 18 and Band 26, the maximum output power requirement is relaxed by reducing the lower tolerance limit by 1.5 dB for transmission bandwidths confined							
	within 815 M	1Hz and 818 I	MHz.					

6.2.2F UE maximum output power for category NB1

Category NB1 UE Power Classes are specified in Table 6.2.2F-1 and define the maximum output power for any transmission bandwidth within the category NB1 channel bandwidth. For 3.75 kHz sub-carrier spacing the maximum output power is defined as mean power of measurement which period is at least one slot (2ms) excluding the 2304Ts gap when UE is not transmitting. For 15kHz sub-carrier spacing the maximum output power is defined as mean power of measurement which period is at least one sub-frame (1ms).

NOTE 6: Void

Class 5 **EUTRA** Class 3 **Tolerance** Tolerance band (dBm) (dB) (dBm) (dB) 23 20 1 ±2 ±2 2 23 ±2 20 ±2 23 3 ±2 20 ±2 5 20 ±2 23 20 ±2 <u>+2</u> 8 23 12 ±2 20 ±2 13 23 ±2 20 ±2 23 ±2 17 ±2 20 18 23 ±2 ±2 20 19 23 ±2 20 ±2 ±2 20 23 ±2 20 26 23 ±2 20 ±2 20 28 23 ±2 ±2 66 23 20 ±2 ±2

Table 6.2.2F-1: UE Power Class

6.2.3 UE maximum output power for modulation / channel bandwidth

For UE Power Class 1 and 3, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2-1 due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3-1.

Table 6.2.3-1: Maximum Power Reduction (MPR) for Power Class 1 and 3

Modulation	Cha	N _{RB})	MPR (dB)				
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3

For PRACH, PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For transmissions with non-contiguous resource allocation in single component carrier, the allowed Maximum Power Reduction (MPR) for the maximum output power in table 6.2.2-1, is specified as follows

$$MPR = CEIL \{M_A, 0.5\}$$

Where M_A is defined as follows

 $M_A = 8.00-10.12A$; $0.00 < A \le 0.33$

5.67 - 3.07A ; $0.33 < A \le 0.77$

3.31 ; $0.77 < A \le 1.00$

Where

 $A = N_{RB_alloc} / N_{RB}.$

CEIL{M_A, 0.5} means rounding upwards to closest 0.5dB, i.e. MPR \in [3.0, 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0]

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5 apply.

6.2.3A UE Maximum Output power for modulation / channel bandwidth for CA

For inter-band carrier aggregation with one uplink component carrier assigned to one E-UTRA band, the requirements in subclause 6.2.3 apply. For inter-band carrier aggregation with two uplink contiguous component carrier assigned to one E-UTRA band the requirements specified in this clause for intra-band contiguous carrier aggregation apply for that band.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the requirements in subclause 6.2.3 apply for each uplink component carrier.

For intra-band contiguous carrier aggregation the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1due to higher order modulation and contiguously aggregated transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3A-1. In case the modulation format is different on different component carriers then the MPR is determined by the rules applied to higher order of those modulations.

CA bandwidth Class B and C / Smallest Modulation **MPR Component Carrier Transmission** (dB) **Bandwidth Configuration** 25 RB 50 RB 75 RB 100 RB QPSK > 8 and ≤ > 12 and > 16 and > 18 and ≤ 1 ≤ 50 ≤ 75 ≤ 100 QPSK > 25 > 50 > 75 > 100 ≤ 2 **16 QAM** ≤ 8 ≤ 12 ≤ 16 ≤ 18 ≤ 1 16 QAM > 12 and ≤ 2 > 8 and ≤ > 16 and > 18 and 25 ≤ 50 ≤ 100 ≤ 75 16 QAM > 25 > 50 > 75 > 100 ≤ 3 64 QAM ≤ 8 and ≤ 12 and ≤ 16 and ≤ 18 and ≤ 2 allocation allocation allocation allocation wholly wholly wholly wholly contained contained contained contained within a within a within a within a single CC single CC single CC single CC 64 QAM > 8 or > 12 or > 16 or > 18 or ≤ 3 allocation allocation allocation allocation extends extends extends extends across across across across two CC's two CC's two CC's two CC's

Table 6.2.3A-1: Maximum Power Reduction (MPR) for Power Class 3

For PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For intra-band contiguous carrier aggregation bandwidth class C with non-contiguous resource allocation, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1 is specified as follows

$$MPR = CEIL \{ min(M_A, M_{IM5}), 0.5 \}$$

Where MA is defined as follows

 $\begin{array}{lll} M_A = & 8.2 & ; 0 \leq A < 0.025 \\ & 9.2 - 40A & ; 0.025 \leq A < 0.05 \\ & 8 - 16A & ; 0.05 \leq A < 0.25 \\ & 4.83 - 3.33A & ; 0.25 \leq A \leq 0.4, \\ & 3.83 - 0.83A & ; 0.4 \leq A \leq 1, \end{array}$

and M_{IM5} is defined as follows

 $M_{IM5} = 4.5$; $\Delta_{IM5} < 1.5 * BW_{Channel CA}$

$$5.0 \hspace{1cm} ; \hspace{1cm} 1.5 \hspace{1cm} * \hspace{1cm} BW_{Channel_CA} \hspace{-0.5cm} \leq \hspace{-0.5cm} \Delta_{IM5} \hspace{-0.5cm} < \hspace{1cm} BW_{Channel_CA} \hspace{-0.5cm} / 2 \hspace{1cm} + \hspace{1cm} F_{OOB}$$

$$M_A$$
 ; $\Delta_{IM5} \ge BW_{Channel\ CA}/2 + F_{OOB}$

For intra-band contiguous carrier aggregation bandwidth class B with non-contiguous resource allocation, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2A-1 is specified as follows

$$MPR = CEIL \{ M_A, 0.5 \}$$

Where MA is defined as follows

$$\begin{split} M_A = & \ 10.5 - 17.5A \ ; \ 0 \leq A < 0.2 \\ 8.5 - 7.5A & \ ; \ 0.2 \leq A < 0.6 \\ 5.5 - 2.5A & \ ; \ 0.6 \leq A \leq 1 \end{split}$$

Where

$$A = N_{RB \text{ alloc}} / N_{RB \text{ agg.}}$$

$$\begin{split} &\Delta_{IM5} = max(\mid F_{C_agg} - (3*F_{agg_alloc_low} - 2*F_{agg_alloc_high})\mid, \mid F_{C_agg} - (3*F_{agg_alloc_high} - 2*F_{agg_alloc_low})\mid) \\ &F_{C_agg} = (F_{edge_high} + F_{edge_low})/2 \end{split}$$

CEIL{ M_A , 0.5} means rounding upwards to closest 0.5dB, i.e. MPR \in [3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5].

For intra-band non-contiguous carrier aggregation with one uplink carrier, the requirements in subclause 6.2.3 apply.

For intra-band non-contiguous carrier aggregation with two uplink carriers MPR is specified for E-UTRA CA configurations with a maximum possible $W_{GAP} \le 35$ MHz; the allowed MPR is

$$MPR = CEIL \{M_N, 0.5\}$$

where M_N is defined as follows

$$M_{N} = -0.125 \text{ N} + 18.25 \qquad ; 2 \le N \le 50$$

$$-0.0333 \text{ N} + 13.67 \qquad ; 50 < N \le 200$$

where $N=N_{RB_alloc}$ is the number of allocated resource blocks. Clause 6.2.3 does not apply in addition. E-UTRA CA configurations with a maximum possible $W_{gap} > 35$ MHz and their corresponding MPR are intended to form part of a later release.

For intra-band carrier aggregation, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) on all component carriers within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the requirements specified in subclause 6.2.3 apply for the E-UTRA band supporting one component carrier, and for the E-UTRA band supporting two contiguous component carriers the requirements specified in subclause 6.2.3A apply.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5A apply.

6.2.3B UE maximum output power for modulation / channel bandwidth for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2B-1 is specified in Table 6.2.3-1. The requirements shall be met with UL-MIMO configurations defined in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5B apply.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.3 apply.

6.2.3D UE maximum output power for modulation / channel bandwidth for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, this subclause specifies the allowed Maximum Power Reduction (MPR) power for ProSe physical channels and signals due to higher order modulation and transmit bandwidth configuration (resource blocks).

The allowed MPR for the maximum output power for ProSe physical channels PSDCH, PSCCH, PSSCH, and PSBCH shall be as specified in subclause 6.2.3 for PUSCH for the corresponding modulation and transmission bandwidth.

The allowed MPR for the maximum output power for ProSe physical signal PSSS shall be as be as specified in subclause 6.2.3 for PUSCH QPSK modulation for the corresponding transmission bandwidth.

The allowed MPR for the maximum output power for ProSe physical signal SSSS is specified in Table 6.2.3D-1.

Table 6.2.3D-1: Maximum Power Reduction (MPR) for SSSS for Power Class 1 and 3

Channel bandwidth	MPR for SSSS (dB)
1.4 MHz	
3.0 MHz	
5.0 MHz	≤ 4
10 MHz	≤ 4
15 MHz	≤ 4
20 MHz	≤ 4

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.2.3D apply for ProSe transmission and the requirements in subclause 6.2.3 apply for uplink transmission.

6.2.3E UE maximum output power for modulation / channel bandwidth for category M1

For UE Power Class 3 and 5, the allowed Maximum Power Reduction (MPR) for the maximum output power specified in Table 6.2.2E-1 due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3E-1 and 6.2.3E-2 respectively.

Table 6.2.3E-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Cha	Channel bandwidth / Transmission bandwidth (NRB)								
	1.4 MHz									
QPSK	>2	>2	>1	>4	-	-	≤ 1			
QPSK	>5	>5	-	-	-	-	≤ 2			
16 QAM	≤ 2	≤ 2	>1	>3	-	-	≤ 1			
16QAM	>2	>2	>3	>5	-	-	≤ 2			

Table 6.2.3E-2: Maximum Power Reduction (MPR) for Power Class 5

Modulation	Cha	MPR (dB)					
	1.4	20					
	MHz	MHz	MHz	MHz	MHz	MHz	

L	QPSK	>2	>2	>3	>5	-	-	≤ 1
	QPSK	>5	>5	-	-	-	1	≤ 2
	16 QAM	≤ 2	≤ 2	>3	>5	-	-	≤ 1
	16QAM	>2	>2	>5	-	-	-	≤ 2

For PRACH, PUCCH and SRS transmissions, the allowed MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5 apply.

No other MPR requirement than those specified in tables 6.2.3E-1 and Table 6.2.3E-2 applies to category M1 UE.

6.2.3F UE maximum output power for modulation / channel bandwidth for category NB1

For UE category NB1 power class 3 and 5 the allowed Maximum Power Reduction (MPR) for the maximum output power given in Table 6.2.2F-1 is specified in Table 6.2.3F-1.

Table 6.2.3F-1: Maximum Power Reduction (MPR) for UE category NB1 Power Class 3 and 5

Modulation		QP	SK	
Tone positions for 3 Tones allocation	0-2	3-5 ar	nd 6-8	9-11
MPR	≤ 0.5 dB	0 (dB	≤ 0.5 dB
Tone positions for 6 Tones allocation	0-5 and 6-11			
MPR	≤ 1 d	В	<u> </u>	1 dB
Tone positions for 12 Tones allocation	0-11			
MPR ≤ 2 dB				

For the UE maximum output power modified by MPR, the power limits specified in sub-clause 6.2.5F apply.

6.2.4 UE maximum output power with additional requirements

Additional ACLR and spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power as specified in Table 6.2.2-1. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For UE Power Class 1 and 3 the specific requirements and identified subclauses are specified in Table 6.2.4-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4-1 to 6.2.4-15 are in addition to the allowed MPR requirements specified in subclause 6.2.3.

Table 6.2.4-1: Additional Maximum Power Reduction (A-MPR)

Network Signalling value	Requirements (subclause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (<i>N</i> _{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.5-1	1.4, 3, 5, 10, 15, 20	Table 5.6-1	N/A
			3	>5	≤ 1
		0 440 00 05	5	>6	≤1
NS_03	6.6.2.2.1	2, 4,10, 23, 25,	10	>6	≤1
		35, 36, 66	15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.2, 6.6.3.3.19	41	5, 10, 15, 20	Table	6.2.4-4
		1	10,15,20	≥ 50 (NOTE1)	≤ 1 (NOTE1)
NS_05	6.6.3.3.1		15, 20	Table 6.2.4	-18 (NOTE2)
		CE (NOTE 2)	10,15,20	≥ 50	≤ 1 (NOTE 1)
		65 (NOTE 3)	15,20	Table 6.2.4	-18 (NOTE 2)
NS_06	6.6.2.2.3	12, 13, 14, 17	1.4, 3, 5, 10	Table 5.6-1	N/A
NS_07	6.6.2.2.3 6.6.3.3.2	13	10	Table	6.2.4-2
NS_08	6.6.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.4	21	10, 15	> 40	≤1
	0.0.3.3.4		,	> 55	≤ 2
NS_10		20	15, 20	Table	6.2.4-3
NS_11	6.6.2.2.1 6.6.3.3.13	23	1.4, 3, 5, 10, 15, 20	Table	6.2.4-5
NS_12	6.6.3.3.5	26	1.4, 3, 5, 10, 15	Table	6.2.4-6
NS_13	6.6.3.3.6	26	5	Table	6.2.4-7
NS_14	6.6.3.3.7	26	10, 15	Table	6.2.4-8
NS_15	6.6.3.3.8	26	1.4, 3, 5, 10, 15		6.2.4-9 6.2.4-10
NS_16	6.6.3.3.9	27	3, 5, 10		, Table 6.2.4-12, 6.2.4-13
NS_17	6.6.3.3.10	28	5, 10	Table 5.6-1	N/A
NS 10	6.6.3.3.11	28	5	≥ 2	≤1
NS_18	0.0.3.3.11		10, 15, 20	≥ 1	≤ 4
NS_19	6.6.3.3.12	44	10, 15, 20	Table	6.2.4-14
NS_20	6.2.2 6.6.2.2.1 6.6.3.3.14	23	5, 10, 15, 20	Table	6.2.4-15
NS_21	6.6.2.2.1 6.6.3.3.15	30	5, 10	Table	6.2.4-16
NS_22	6.6.3.3.16	42, 43	5, 10, 15, 20	Table	6.2.4-17
NS_23	6.6.3.3.17	42, 43	5, 10, 15, 20	N	I/A
NS_24	6.6.3.3.20	65 (NOTE 4)	5, 10, 15, 20	Table	6.2.4-19
NS_25	6.6.3.3.21	65 (NOTE 4)	5, 10, 15, 20	Table	6.2.4-20
NS_26	6.6.3.3.22	68	10, 15		6.2.4-21
NS_32	-	-	-	-	-
NS_36	6.6.3.3.28	68	5, 10, 15		6.2.4-27

NOTE 1 Applicable when the lower edge of the assigned E-UTRA UL channel bandwidth frequency is larger than or equal to the upper edge of PHS band (1915.7 MHz) + 4 MHz + the channel BW assigned, where channel BW is as defined in subclause 5.6. A-MPR for operations below this frequency is not covered in this version of specifications except for the channel assignments in NOTE2 as the emissions requirement in 6.6.3.3.1 may not be met. For 10MHz channel bandwidth whose carrier frequency is larger than or equal to 1945 MHz or 15 MHz channel bandwidth whose carrier frequency is larger than or equal to 1947.5 MHz, no A-MPR applies.

NOTE 2 Applicable when carrier frequency is 1932.5 MHz for 15MHz channel bandwidth or 1930 MHz for 20MHz channel bandwidth case.

NOTE 3: Applicable when the E-UTRA carrier is within 1920-1980 MHz.

NOTE 4: Applicable when the upper edge of the channel bandwidth frequency is greater than 1980MHz.

Table 6.2.4-2: A-MPR for "NS_07"

Parameters	Re	egion A	Regio	on B	Region C
RB _{start}	(0 - 12	13 – 18	19 – 42	43 – 49
LCRB [RBs]	6-8	1 to 5 and 9-50	≥8	≥18	≤2
A-MPR [dB]	≤ 8	≤ 12	≤ 12	≤ 6	≤ 3

NOTE 1; RB_{start} indicates the lowest RB index of transmitted resource blocks

NOTE 2; LCRB is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a per slot basis.

NOTE 4; For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.

Table 6.2.4-3: A-MPR for "NS_10"

Channel bandwidth [MHz]	Parameters	Region A
	RB _{start}	0 – 10
15	LCRB [RBs]	1 -20
	A-MPR [dB]	≤ 2
	RB _{start}	0 – 15
20	LCRB [RBs]	1 -20
	A-MPR [dB]	≤5

NOTE 1: RB_{start} indicates the lowest RB index of transmitted resource blocks

NOTE 2: L_{CRB} is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping which intersects Region A, notes 1 and 2 apply on a per slot basis

NOTE 4: For intra-subframe frequency hopping which intersect Region A, the larger A-MPR value may be applied for both slots in the subframe

Table 6.2.4-4: A-MPR requirements for "NS_04" with bandwidth >5MHz

Channel bandwidth [MHz]		Parameters										
5	Fc [MHz]				≤ 2499.5			> 2499.5				
	RB _{start}			0 - 8		9 –	24	0 - 24				
	L _{CRB} [RBs]			> 0		>	0	> 0				
	A-MPR [dB]			≤ 2		()	0				
10	Fc [MHz]				≤ 2504			> 2504				
	RB _{start}			0 - 8		9 - 35	36 - 49	0 - 49				
	LCRB [RBs]	≤ 15	> 15	and < 25	≥ 25	N/A	> 0	> 0				
	RB _{start} + L _{CRB}	N/A	N/A		N/A	≥ 45	N/A	N/A				
	A-MPR [dB]	≤ 3		≤ 1	≤ 2	≤ 1	0	0				
15	Fc [MHz]				≤ 2510.8			> 2510.8				
	RB _{start}			0 - 13		14 – 59	60 – 74	0 - 74				
	LCRB [RBs]	≤ 18 o	r ≥ 36	> 18 a	and < 36	N/A	> 0	> 0				
	RB _{start} + L _{CRB} [RBs]	N/	A	1	N/A	≥ 62	N/A	N/A				
	A-MPR [dB]	≤ :	3	:	≤ 1	≤ 1	0	0				
20	Fc [MHz]				≤ 2517.5			> 2517.5				
	RB _{start}		0 – 22				77 – 99	0 - 99				
	LCRB [RBs]	≤ 18 o	r ≥ 40	> 18 a	and < 40	N/A	> 0	> 0				
	RB _{start} + L _{CRB} [RBs]	N/	A	1	N/A	≥ 86	N/A	N/A				
	A-MPR [dB]	≤ 1	3		≤ 1	≤ 1	0	0				

- NOTE 1: RB_{start} indicates the lowest RB index of transmitted resource blocks
- NOTE 2: LCRB is the length of a contiguous resource block allocation
- NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe

Table 6.2.4-5: A-MPR for "NS_11"

Channel Bandwidth [MHz]	Parameters								
	Fc [MHz]	<20				≥2004			
3	LCRB [RBs]	1-1				>5			
	A-MPR [dB]	≤(000	≤1	0007		0007
	Fc [MHz]	<20	04		200)4 ≤ Fc <	2007	2	2007
5	LCRB [RBs]	1-2	25		1-6 15-	6 & -25	8-12		>6
	A-MPR [dB]	≤7	7		≤	4	0		≤ 1
	Fc [MHz]	200)5 ≤	Fc <2	2015			2015	
40	RB _{start}		0	-49				0-49	
10	L _{CRB} [RBs]	1-50			1-50				
	A-MPR [dB]	≤ 12			0				
	Fc [MHz]		<2012.5						
	RBstart	0-4		5-21			22	-56	57-74
	L _{CRB} [RBs]	≥1	7-50 0-6 & ≥		6 & ≥50	≤25	>25	>0	
	A-MPR [dB]	≤15	⊻	7		≤10	0	≤6	≤15
15	Fc [MHz]					2012	.5		
	RB _{start}	0-12			13-	39	40-6	5	66-74
	LCRB [RBS]	≥1		≥3	0	<30	≥ (69 – RB _{start})		≥1
	A-MPR [dB]	≤10		≤6	3	0	≤2		≤6.5
	Fc [MHz]					2010)		
	RB _{start}	0-12		1:	3-29)	30-68		69-99
20	L _{CRB} [RBs]	≥1	10	-60	,	1-9 & >60	1-24	≥25	≥1
	A-MPR [dB]	≤15	5	≤7		≤10	0	≤7	≤15

Table 6.2.4-6: A-MPR for "NS_12"

Channel bandwidth [MHz]	Parameters	Regi	Region B	
	RB _{start}	()	1-2
1.4	LCRB [RBs]	≤3	≥4	≥4
	A-MPR [dB]	≤3	≤6	≤3
	RB _{start}	0	-3	4-5
3	LCRB [RBs]	1-15		≥9
	A-MPR [dB]	≤4		≤3
	RB _{start}	0	-6	0-9
5	LCRB [RBs]	<u> </u>	8	≥9
	A-MPR [dB]	<u> </u>	5	≤3
	RB _{start}	0-	15	0-22
10	L _{CRB} [RBs]	≤′	18	≥20
	A-MPR [dB]	≤4		≤2
	RB _{start}	0-30		0-30
15	L _{CRB} [RBs]	≤;	≥32	
	A-MPR [dB]	<u> </u>	4	≤3

Table 6.2.4-7: A-MPR for "NS_13"

Channel bandwidth [MHz]	Parameters	Region A			
	RB _{start}	0-2	2		
5	L _{CRB} [RBs]	≤5	≥18		
	A-MPR [dB]	≤3	≤2		

Table 6.2.4-8: A-MPR for "NS_14"

Channel bandwidth [MHz]	Parameters	Region A		
	RB _{start}	0		
10	L _{CRB} [RBs]	≤5	=50	
	A-MPR [dB]	≤3	≤1	
	RB _{start}	≥8	3	
15	L _{CRB} [RBs]	≤16	≥50	
	A-MPR [dB]	≤3	≤1	

Table 6.2.4-9: A-MPR for "NS_15" for E-UTRA highest channel edge > 845 MHz and ≤ 849 MHz

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C
1.4	RB _{end} [RB]			4-5
1.4	A-MPR [dB]			≤3
	RB _{end} [RB]	0-1	8-12	13-14
3	LCRB [RB]	≤2	≥8	>0
	A-MPR [dB]	≤4	≤4	≤9
	RB _{end} [RB]	0-4	12-19	20-24
5	LCRB [RB]	≤2	≥8	>0
	A-MPR [dB]	≤4	≤5	≤9
	RB _{end} [RB]	0-12	23-36	37-49
10	LCRB [RB]	≤2	≥15	>0
	A-MPR [dB]	≤4	≤6	≤9
	RB _{end} [RB]	0-20	26-53	54-74
15	LCRB [RB]	≤2	≥20	>0
	A-MPR [dB]	≤4	≤5	≤9

Table 6.2.4-10: A-MPR for "NS_15" for E-UTRA highest channel edge ≤ 845 MHz

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C
	RB _{end} [RB]			19-24
5	LCRB [RB]			≥18
	A-MPR [dB]			≤2
	RB _{end} [RB]	0-4	29-44	45-49
10	LCRB [RB]	≤2	≥24	>0
	A-MPR [dB]	≤4	≤4	≤9
	RB _{end} [RB]	0-12	44-61	62-74
15	LCRB [RB]	≤2	≥20	>0
	A-MPR [dB]	≤4	≤5	≤9

Table 6.2.4-11: A-MPR for "NS_16" with channel lower edge at ≥807 MHz and <808.5 MHz

Channel bandwidth [MHz]	Parameter	Region A	Region B	Region C	Region D	Region E
	RB _{start}	0	1-2			
3 MHz	L _{CRB} [RBs]	≥12	12			
	A-MPR [dB]	≤2	≤1			
	RB _{start}	0-1	2	2-9	2-5	
5 MHz	L _{CRB} [RBs]	1 - 25	12	15-18	20	
	A-MPR [dB]	≤5	≤1	≤2	≤3	
	RB _{start}	0 - 8	0-	14	15-20	15-24
10 MHz	LCRB [RBs]	1 - 12	15-20	≥24	≥30	24-27
	A-MPR [dB]	≤5	≤3	≤7	≤3	≤1

Table 6.2.4-12: A-MPR for "NS_16" with channel lower edge at ≥808.5 MHz and <812 MHz

Channel bandwidth [MHz]	Parameter	Region A	Region B	Region C	Region D	Region E
	RB _{start}	0	0-1	1-5		
5 MHz	L _{CRB} [RBs]	16-20	≥24	16-20		
	A-MPR [dB]	≤2	≤3	≤1		
	RB _{start}	0-	-6	0-10	0-14	11-20
10 MHz	L _{CRB} [RBs]	1-12	15-20	24-32	≥36	24-32
	A-MPR [dB]	≤5	≤2	≤4	≤5	≤1

Table 6.2.4-13: A-MPR for "NS_16" with channel lower edge at ≥812 MHz

Channel bandwidth [MHz]	Parameter	Region A	Region B	Region C	Region D
	RB _{start}	0 - 9	0	1-14	0-5
10 MHz	LCRB [RBs]	27-32	36-40	36-40	≥45
	A-MPR [dB]	≤1	≤2	≤1	≤3

Table 6.2.4-14: A-MPR for "NS_19"

Channel bandwidth [MHz]	Parameters	Region A		Region A		Region B
	RB _{start}			0-6		
10	L _{CRB} [RBs]			≥40		
	A-MPR [dB]					≤1
	RB _{start}	0	-6	7-20		
15	L _{CRB} [RBs]	≤18	≥36	≥42		
	A-MPR [dB]	≤2	≤3	≤2		
	RB _{start}	0-	14	15-30		
20	L _{CRB} [RBs]	≤40	≥45	≥50		
	A-MPR [dB]	≤2	≤3	≤2		

Table 6.2.4-15: A-MPR for "NS_20"

Channel Bandwidth [MHz]	Parameters											
	Fc [MHz]	< 20	< 2007.5 2007.5 ≤ Fc < 2012.5					2012.5 ≤ Fc ≤ 2017.5				
5	RB _{start}	≤:	24		С)-3			4-6	≤2	24	
3	LCRB [RBs]	>	·0	1	5-19	2	20		≥18	1-2	25	
	A-MPR [dB]	≤	17		≤1		≤4		≤2	≤	0	
	Fc [MHz]						2005					
	RB _{start}		0-25				26-34	Ļ		35-	49	
	L _{CRB} [RBs]	>0				8-15	15		15	15 >0		
10	A-MPR [dB]		≤16			≤2			≤5	≤ 6		
10	Fc [MHz]	2015										
	RB _{start}		0	-5				6-10				
	LCRB [RBs]		≥;	32					≥40			
	A-MPR [dB]		<u> </u>	4						≤2		
	Fc [MHz]						2012.5					
15	RB _{start}		0-14				15	-24		25-39	61-74	
15	LCRB [RBs]	1-9 & 4	0-75	10-3	39	24	1-29		≥30	≥36	≤6	
	A-MPR [dB]	≤11		≤6	6		≤1		≤7	≤5	≤6	
	Fc [MHz]						2010					
20	RB _{start}	0-21		22-31			32-3	8	39-49	50-68	69-99	
20	LCRB [RBs]	>0	1-9 & 3	31-75	10-3	30	≥15	; _	≥24	≥25	>0	
	A-MPR [dB]	≤17	≤1:	2	≤6	3	≤9		≤7	≤5	≤16	

NOTE 1: When NS_20 is signaled the minimum requirements for the 10 MHz bandwidth are specified for E-UTRA UL carrier center frequencies of 2005 MHz or 2015 MHz.

NOTE 2: When NS_20 is signaled the minimum requirements for the 15 MHz channel bandwidth are specified for E-UTRA UL carrier center frequency of 2012.5 MHz.

Table 6.2.4-16: A-MPR for "NS_21"

Channel Bandwidth [MHz]	Parameters	Region A		Reç	gion B
	RB _{start}	0 – 6	0 – 6	N/A	N/A
10	RBend	N/A	N/A	43 – 49	43 – 49
10	L _{CRB} [RBs]	1 – 2	3 – 12, 32 - 50	1 – 2	3 – 12, 32 - 50
	A-MPR [dB]	≤ 4	≤3	≤ 4	≤ 3

Table 6.2.4-17: A-MPR for "NS_22"

Channel bandwidth [MHz]	Parameters	Region A	Region B	Region C	Region D			
5	1	No A-MPR is needed for 5 MHz channel bandwidth						
10	RB _{start}	0-13	0-17	≤ 6	≥12			
	LCRB [RBs]	> 36	33-36	≤ 32	≤ 32			
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥44			
	A-MPR [dB]	≤ 4	≤ 3	≤ 3	≤ 3			
15	RB _{start}	0-24	0-38	≤ 14	≥ 23			
	L _{CRB} [RBs]	> 50	37-50	≤ 36	≤ 36			
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥59			
	A-MPR [dB]	≤ 5	≤ 4	≤ 3	≤ 3			
20	RB _{start}	0-35	0-51	≤ 21	≥ 31			
	L _{CRB} [RBs]	> 64	49-64	≤ 48	≤ 48			
	RBstart + LCRB [RBs]	N/A	N/A	N/A	≥79			
	A-MPR [dB]	≤ 5	≤ 4	≤ 3	≤ 3			

NOTE 1; RB_{start} indicates the lowest RB index of transmitted resource blocks NOTE 2; L_{CRB} is the length of a contiguous resource block allocation

NOTE 2; Ecks is the length of a contiguous resource block anocation.

NOTE 3: For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a per slot basis.

NOTE 4; For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.

Table 6.2.4-18: A-MPR for "NS_05"

Channel Bandwidth [MHz]	Parameters							
	Fc [MHz]	MHz] 1932.5						
15	RB _{start}	0-7	8 – 66				67-74	
	LCRB [RBs]	≥1	≤30 31 – 5		54 >	54	≤6	>6
	A-MPR [dB]	≤11	0	≤3	;	≤5	≤5	≤1
	Fc [MHz]				1930			
	RB _{start}	0-23		24	4-75		7	6-99
20	L _{CRB} [RBs]	≥1	≤24	25 – 40	41 – 50	> 50	≤6	>6
	A-MPR [dB]	≤11	0	≤3	≤5	≤10	≤5	≤1

Table 6.2.4-19: A-MPR for "NS_24"

Channel Bandwidth [MHz]		Parameters							
	Fc [MHz]	Fc > [1987.5]							
_	RB _{start}				0 -	24			
5	L _{CRB} [RBs]				0 -	24			
	A-MPR [dB]		≤10						
	Fc [MHz]	1975 < Fc ≤ 1985 1985 Fc>1995 Fc>1995					Fc>1995		
	RB _{start}	0 - 1	2 - 14	15 - 26		36 - 49	() - 49	0 - 49
10	LCRB [RBs]	> 10	≥ 35	N/A	≤ 2	> 11	0 - 49		0 - 49
	RB _{end}	N/A	N/A	> 48	N/A	N/A		N/A	N/A
	A-MPR [dB]	≤ 2	≤ 2	1	≤ 3	≤ 1		≤ 9	≤ 17
	Fc [MHz]		•	1972.5 < Fc ≤	1987.5			Fc>	1987.5
15	RB _{start}	0 - 11 12 - 74 0 - 74					- 74		
	LCRB [RBs]	≤ 4	≤ 45 > 45 > 3 0 - 74						- 74

	RB _{end}	N/A N/A		≥ 45	N/A		
	A-MPR [dB]	≤2	≤ 8	≤ 7	≤ 17		
	Fc [MHz]	Fc > 1970					
20	RB _{start}		0 -	99			
20	LCRB [RBs]	0 - 99					
	A-MPR [dB]	≤ 17					

Table 6.2.4-20: A-MPR for "NS_25"

Channel Bandwidth [MHz]		Parameters													
	Fc [MHz]		Fc > [1997.5]												
	RB _{start}		0 - 9 > 12							10 -	24				
5	L _{CRB} [RBs]									N/	Ά				
	RBend			N/	/A				≥ 22						
	A-MPR [dB]			≤	5							≤	2		
	Fc [MHz]	1975 < F	c ≤ 1985	,		1985	< F	c ≤ 19	995				F	c > 1995	
	RB _{start}	0-1	2-49		()	1 - 18 1		19	9-49	0-6		7-15	16-49	
10	LCRB [RBs]	> 10	N/A		≤ 25	> 25	5	> 2	25	١	N/A	N/A		> 20	N/A
	RB _{end}	N/A	> 48		N/A	N/A	١	N/	Ά	>	42	N/A		N/A	> 35
	A-MPR [dB]	≤ 1	≤ 1		≤ 1	≤ 5		≤	5	:	≤ 1	≤ 10		≤ 7	≤ 11
	Fc [MHz]				1972	2.5 < F	C ≤ ′	1987.5	5					Fc>	1987.5
	RB _{start}	0 -	4		5 - 30			31 -	62		(63 - 74		0 - 74	
15	LCRB [RBs]	≥ 1	5		≥ 45			N/	Α			N/A		0	- 74
	RBend	N/A	4		N/A			> 7	71			N/A		1	N/A
	A-MPR [dB]	≤ 4	1		≤ 3			≤	1			≤ 1		<u> </u>	13
	Fc [MHz]		•		1970) < Fc ≤	199	90						Fc > 1	990
	RB _{start}	0	- 13			14 - 40	40		41 - 99		0 - 99				
20	LCRB [RBs]	ı	N/A			≥ 32			N/A			0 - 99			
	RB _{end}	ı	N/A			N/A		> 72			N/A		4		
	A-MPR [dB]	5	<u> </u>			≤ 11					≤13		≤ 13		

Table 6.2.4-21: A-MPR for "NS_26"

Bandwidth (MHz)	RBstart	L_crb	A-MPR
10	0 - 10	≥ 1	≤ 1
15	0 - 17	≥ 1	≤ 1

Table 6.2.4-27: A-MPR for "NS 36"

Channel Bandwidth [MHz]		F	Parameters		
	Fc [MHz]		700.5 ≤	Fc < 705.5	
5 MHz	RB _{start}		0		1-4
	L _{CRB} [RBs]	1	1 ≥ 15		24
	A-MPR [dB]	≤ 2	≤ 4	≤ 1	≤ 3
	Fc [MHz]				
10 MHz	RB _{start}	0 - 8	9 - 12	13 - 39	40 - 43
IU WIHZ	L _{CRB} [RBs]	> 0	> 12	> 16	> 0
	A-MPR [dB]	≤ 10	≤ 8	≤ 6	≤ 6
	Fc [MHz]		Fc:	= 705.5	
15 MHz	RB _{start}	0 - 16	17 - 23	24 - 56	57 - 60
19 IVIMZ	L _{CRB} [RBs]	> 0	> 12	> 20	< 6
	A-MPR [dB]	≤ 10	≤ 9	≤ 7	≤ 6

NOTE 1: RBstart indicates the lowest RB index of transmitted resource blocks

NOTE 2: LCRB is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping between two regions, notes 1 and 2 apply on a per slot basis.

NOTE 4: For intra-subframe frequency hopping between two regions, the larger A-MPR value of the two regions may be applied for both slots in the subframe.

For PRACH, PUCCH and SRS transmissions, the allowed A-MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For each subframe, the A-MPR is evaluated per slot and given by the maximum value taken over the transmission(s) within the slot; the maximum A-MPR over the two slots is then applied for the entire subframe.

For the UE maximum output power modified by A-MPR, the power limits specified in subclause 6.2.5 apply.

6.2.4A UE maximum output power with additional requirements for CA

Additional ACLR, spectrum emission and spurious emission requirements for carrier aggregation can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the CA Power Class as specified in Table 6.2.2A-1.

If for intra-band carrier aggregation the UE is configured for transmissions on a single serving cell, then subclauses 6.2.3 and 6.2.4 apply with the Network Signaling value indicated by the field *additionalSpectrumEmission*.

For intra-band contiguous aggregation with the UE configured for transmissions on two serving cells, the maximum output power reduction specified in Table 6.2.4A-1 is allowed for all serving cells of the applicable uplink CA configurations according to the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10*. Then clause 6.2.3A does not apply, i.e. the carrier aggregation MPR = 0dB, unless the value indicated is CA_NS_31. For uplink 64QAM, the applied maximum output power reduction is obtained by taking the maximum value of MPR requirements specified in Table 6.2.3A-1 and A-MPR requirements specified in Table 6.2.4A-1.

Table 6.2.4A-1: Additional Maximum Power Reduction (A-MPR) for intra-band contiguous CA

CA Network Signalling value	Requirements (subclause)	Uplink CA Configuration	A-MPR [dB] (subclause)
CA_NS_01	6.6.3.3A.1	CA_1C	6.2.4A.1
CA_NS_02	6.6.3.3A.2	CA_1C	6.2.4A.2
CA_NS_03	6.6.3.3A.3	CA_1C	6.2.4A.3
CA_NS_04	6.6.2.2A.1, 6.6.3.3A.8	CA_41C	6.2.4A.4
CA_NS_05	6.6.3.3A.4	CA_38C	6.2.4A.5
CA_NS_06	6.6.3.3A.5	CA_7C	6.2.4A.6
CA_NS_07	6.6.3.3A.6	CA_39C	6.2.4A.7
CA_NS_08	6.6.3.3A.7	CA_42C	6.2.4A.8
CA_NS_31	NOTE 1	Table 5.6A.1-1 (NOTE 1)	N/A
CA_NS_32		Reserved	

NOTE 1: Applicable for uplink CA configurations listed in Table 5.6A.1-1 for which none of the additional requirements in subclauses 6.6.2.2A or 6.6.3.3A apply.

NOTE 2: The index of the sequence CA_NS corresponds to the value of additionalSpectrumEmissionSCell-r10.

If for intra-band non-contigous carrier aggregation the UE is configured for transmissions on a single serving cell, then subclauses 6.2.3 and 6.2.4 apply with the Network Signaling value indicated by the field *additionalSpectrumEmission*.

For intra-band non-contiguous carrier aggregation with the UE configured for transmissions on two serving cells, the maximum output power reduction specified in Table 6.2.4A-2 is allowed for all serving cells of the applicable uplink CA configurations according to the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10*. MPR as specified in subclause 6.2.3A is not allowed in addition, unless A-MPR is N/A.

Table 6.2.4A-2: Additional Maximum Power Reduction (A-MPR) for intra-band non-contiguous CA

CA Network Signalling value	in order of increas	Additional requirements for sub-blocks in order of increasing uplink carrier frequency		A-MPR for sub-blocks in order of increasing uplink carrier frequency
	Requirements (subclause)	Requirements (subclause)		A-MPR [dB] (subclause)
CA_NC_NS_01	6.6.2.2.1 (NS_03)	6.6.2.2.1 (NS_03)	CA_4A-4A	N/A
CA_NC_NS_31	NOTE 1	NOTE 1	Table 5.6A.1-3 (NOTE 1)	N/A
CA_NC_NS_32			Reserved	

NOTE 1: Applicable for uplink CA configurations listed in Table 5.6A.1-3 for which the additional requirements in subclause 6.6.2.1.1 (indicated by NS_01) applies in each sub-block.

NOTE 2: The index of the sequence CA_NC_NS corresponds to the value of additionalSpectrumEmissionSCell-r10.

If for inter-band carrier aggregation the UE is configured for transmissions on a single serving cell, then subclauses 6.2.3 and 6.2.4 apply with the Network Signaling value indicated by the field *additionalSpectrumEmission*.

For inter-band carrier aggregation with the UE configured for transmissions on two serving cells the maximum output power reduction specified in Table 6.2.4-1 is allowed for each serving cell of the applicable uplink CA configuration according to the Network Signaling value indicated by the field *additionalSpectrumEmission* for the PCC and the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10* for the SCC. The value of *additionalSpectrumEmissionSCell-r10* is equal to that of *additionalSpectrumEmission* configured on the SCC. MPR as specified in subclause 6.2.3A is allowed in addition.

For PUCCH and SRS transmissions, the allowed A-MPR is according to that specified for PUSCH QPSK modulation for the corresponding transmission bandwidth.

For intra-band carrier aggregation, the A-MPR is evaluated per slot and given by the maximum value taken over the transmission(s) on all component carriers within the slot; the maximum A-MPR over the two slots is then applied for the entire subframe.

For combinations of intra-band and inter-band carrier aggregation with the UE configured for transmission on three serving cells (up to two contiguously aggregated carriers per band), the maximum output power reduction is specified

as follows. For the band supporting one serving cell the maximum output power reduction specified in Table 6.2.4-1 is allowed according to the Network Signaling value indicated by the field *additionalSpectrumEmission* for the PCC and the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10* for the SCC. The value of *additionalSpectrumEmissionSCell-r10* is equal to that of *additionalSpectrumEmission* configured on the SCC. MPR as specified in subclause 6.2.3A is allowed in addition. For the band supporting intra-band contiguous aggregation with the UE configured for transmissions on two serving cells, the maximum output power reduction specified in Table 6.2.4A-1 is allowed for all serving cells of the applicable uplink CA configurations according to the CA network signalling value indicated by the field *additionalSpectrumEmissionSCell-r10*. Then clause 6.2.3A does not apply, i.e. the carrier aggregation MPR = 0dB, unless the value indicated is CA_NS_31. For uplink 64QAM, the applied maximum output power reduction is obtained by taking the maximum value of MPR requirements specified in Table 6.2.3A-1 and A-MPR requirements specified in Table 6.2.4A-1.

For the UE maximum output power modified by A-MPR specified in table 6.2.4A-1, the power limits specified in subclause 6.2.5A apply.

6.2.4A.1 A-MPR for CA_NS_01 for CA_1C

If the UE is configured to CA_1C and it receives IE CA_NS_01 the allowed maximum output power reduction applied to transmissions on the PCC and the SCC for contiguously aggregated signals is specified in table 6.2.4A.1-1.

Table 6.2.4A.1-1: Contiguous allocation A-MPR for CA_NS_01

CA_1C: CA_NS_01	RB _{start}	LCRB [RBs]	RB _{start} + L _{CRB} [RBs]	A-MPR for QPSK, 16- QAM and 64-QAM [dB]
100 RB / 100 RB	0 – 23 and 176 – 199	> 0	N/A	≤ 12.0
	24 – 105	> 64	N/A	≤ 6.0
	106 – 175	N/A	> 175	≤ 5.0
	0 – 6 and 143	0 < L _{CRB} ≤ 10	N/A	≤ 11.0
75 DD / 75 DD	– 149	> 10	N/A	≤ 6.0
75 RB / 75 RB	7 – 90	> 44	N/A	≤ 5.0
	91 – 142	N/A	> 142	≤ 2.0

NOTE 1: RB_start indicates the lowest RB index of transmitted resource blocks

NOTE 2: L_CRB is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot

basis

NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be

applied for both slots in the subframe

If the UE is configured to CA_1C and it receives IE CA_NS_01 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

A-MPR = CEIL
$$\{M_A, 0.5\}$$

Where MA is defined as follows

$$\begin{array}{ll} M_A = & -22.5 \ A + 17 & ; \ 0 \leq A < 0.20 \\ \\ -11.0 \ A + 14.7 & ; \ 0.20 \leq A < 0.70 \\ \\ -1.7 \ A + 8.2 & ; \ 0.70 \leq A \leq 1 \end{array}$$

Where $A = N_{RB_alloc} / N_{RB_agg}$.

6.2.4A.2 A-MPR for CA NS 02 for CA 1C

If the UE is configured to CA_1C and it receives IE CA_NS_02 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.2-1.

A-MPR for QPSK, 16-CA 1C: CA NS 02 **RB**end L_{CRB} [RBs] QAM and 64-QAM [dB] 0 - 20≤ 4 dB > 0 ≤ 3 dB 21 - 46> 0 100 RB / 100 RB 47 – 99 ≤ 3 dB > RB_{end} - 20 100 - 184> 75 ≤ 6 dB 185 - 199≤ 10 dB > 0 0 - 48> 0 ≤ 2 dB 49 - 80> RB_{end} - 20 ≤ 3 dB 75 RB / 75 RB 81 - 129> 60 ≤ 5 dB 130 - 149> 84 ≤ 6 dB 130 - 1491 - 84≤ 2 dB

Table 6.2.4A.2-1: Contiguous allocation A-MPR for CA_NS_02

If the UE is configured to CA_1C and it receives IE CA_NS_02 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

$$A\text{-MPR} = CEIL \{M_{A,} 0.5\}$$

Where MA is defined as follows

$$\begin{array}{lll} M_A = & -22.5 \ A + 17 & ; \ 0 \leq A < 0.20 \\ & -11.0 \ A + 14.7 & ; \ 0.20 \leq A < 0.70 \\ & -1.7 \ A + 8.2 & ; \ 0.70 \leq A \leq 1 \end{array}$$

Where $A = N_{RB_alloc} \, / \, N_{RB_agg.}$

6.2.4A.3 A-MPR for CA_NS_03 for CA_1C

If the UE is configured to CA_1C and it receives IE CA_NS_03 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.3-1.

Table 6.2.4A.3-1: Contiguous allocation A-MPR for CA NS 03

CA_1C: CA_NS_03	RB _{end}	LCRB [RBS]	A-MPR for QPSK, 16- QAM and 64-QAM [dB]
	0 – 26	> 0	≤ 10 dB
	27 – 63	≥ RB _{end} - 27	≤ 6 dB
100 RB / 100 RB	27 – 63	< RB _{end} - 27	≤ 1 dB
100 KB / 100 KB	64 – 100	> RB _{end} - 20	≤ 4 dB
	101 – 171	> 68	≤ 7 dB
	172 – 199	> 0	≤ 10 dB
	0 – 20	> 0	≤ 10 dB
	21 – 45	> 0	≤ 4 dB
75 RB / 75 RB	46 – 75	> RB _{end} – 13	≤ 2 dB
75 KB / 75 KB	76 – 95	> 45	≤ 5 dB
	96 – 149	> 43	≤ 8 dB
	120 – 149	1 - 43	≤ 6 dB

If the UE is configured to CA_1C and it receives IE CA_NS_03 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

$$A-MPR = CEIL \{M_A, 0.5\}$$

Where MA is defined as follows

$$M_A = -23.33A + 17.5$$
 ; $0 \le A < 0.15$ $-7.65A + 15.15$; $0.15 \le A \le 1$

Where $A = N_{RB_alloc} / N_{RB_agg.}$

6.2.4A.4 A-MPR for CA_NS_04

If the UE is configured to CA_41C or any uplink inter-band CA configuration containing CA_41C and it receives IE CA_NS_04 the allowed maximum output power reduction applied to transmission on two component carriers for contiguously aggregated signals is specified in Table 6.2.4A.4-1.

Table 6.2.4A.4-1: Contiguous Allocation A-MPR for CA_NS_04

CA Bandwidth Class C	RB _{Start}	L _{CRB} [RBs]	RB _{start} + L _{CRB} [RBs]	A-MPR for QPSK [dB]	A-MPR for 16QAM and 64QAM [dB]
25 RB / 100 RB	0 - 34 and 90 - 124	>0	N/A	≤3dB	≤3.5dB
	35 – 89	N/A	>90	≤1dB	≤2.5dB
50RB / 100 RB	0 - 44 and 105 - 149	>0	N/A	≤4dB	≤4dB
	45 – 104	N/A	>105	≤3dB	≤4dB
75 RB / 75 RB	0 – 44 and 105 – 149	>0	N/A	≤4dB	≤4dB
	45 – 104	N/A	>105	≤4dB	≤4dB
100 RB / 75 RB	0 – 49 and 125 – 174	>0	N/A	≤4dB	≤4dB
	50 - 124	N/A	>125	≤3dB	≤4dB
100 RB / 100 RB	0 – 59 and 140 – 199	>0	N/A	≤3dB	≤4dB
	60– 139	N/A	>140	≤3dB	≤4dB

NOTE 1: RB_{start} indicates the lowest RB index of transmitted resource blocks

NOTE 2: L_{CRB} is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis

NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe

If the UE is configured to CA_41C or any uplink inter-band CA configuration containing CA_41C and it receives IE CA_NS_04 the allowed maximum output power reduction applied to transmissions on two serving cells assigned to Band 41 with non-contiguous resource allocation is defined as follows

$$A\text{-MPR} = CEIL \{M_{A}, 0.5\}$$

Where MA is defined as follows

$$\begin{array}{lll} M_A & = & 11, & 0 \! \leq \! A < 0.05 \\ & = -55.0A + 13.75, & 0.05 \! \leq \! A < 0.15 \\ & = -4.0A + 6.10, & 0.15 \! \leq \! A < 0.40 \\ & = -0.83A + 4.83, & 0.40 \! \leq \! A \! \leq \! 1 \end{array}$$

Where $A = N_{RB_alloc} / N_{RB_agg.}$

6.2.4A.5 A-MPR for CA NS 05 for CA 38C

If the UE is configured to CA_38C and it receives IE CA_NS_05 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.5-1.

Table 6.2.4A.5-1: Contigous Allocation A-MPR for CA_NS_05

CA_38C	RB _{end}	L _{CRB} [RBs]	A-MPR for QPSK, 16- QAM and 64-QAM [dB]
100RB/100RB	0 – 12	>0	≤ 5 dB
	13 – 79	> RB _{end} - 13	≤ 2 dB
	80 – 180	>60	≤ 6 dB
	181 – 199	> 0	≤ 11 dB
75RB/75RB	0 – 70	> max (0, RB _{end} -10)	≤ 2 dB
	71- 108	> 60	≤ 5 dB
	109 – 139	>0	≤ 5 dB
	140 – 149	≤ 70	≤ 2 dB
	140 – 149	>70	≤ 6 dB

NOTE 1: RBend indicates the highest RB index of transmitted resource blocks

NOTE 2: L_{CRB} is the length of a contiguous resource block allocation

NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis

NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe

If the UE is configured to CA_38C and it receives IE CA_NS_05 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

$$A-MPR = CEIL \{M_A, 0.5\}$$

Where MA is defined as follows

 $M_A = \text{-}14.17 \ A + 16.50 \qquad ; \ 0 \leq A < 0.60$

-2.50 A + 9.50 ; $0.60 \le \text{A} \le 1$

Where $A = N_{RB_alloc} / N_{RB_agg}$.

6.2.4A.6 A-MPR for CA_NS_06

If the UE is configured to CA_7C and it receives IE CA_NS_06 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.6-1.

Table 6.2.4A.6-1: Contiguous Allocation A-MPR for CA_NS_06

CA Bandwidth Class C	RB _{end}	L _{CRB} [RBs]	A-MPR for QPSK, 16- QAM and 64-QAM [dB]
	0 –22	>0	≤ 4 dB
	23 – 99	> max(0,RB _{end} - 25)	≤ 2 dB
100RB/100RB	100 – 142	> 75	≤ 3 dB
	143 – 177	>70	≤ 5 dB
	178 – 199	> 0	≤ 10 dB
	0 – 7	>0	≤ 5 dB
	8- 74	> max(0,RB _{end} - 10)	≤ 2 dB
75RB/75RB	75 – 109	>64	≤ 2 dB
	110 – 144	>35	≤ 6 dB
	145 – 149	>0	≤ 10 dB
	0 – 10	> 0	≤ 5 dB
50RB/100RB	11 – 75	> max(0, RB_End - 25)	≤ 2 dB
and	76 – 103	> 50	≤ 3 dB
100RB/50RB	104 – 144	> 25	≤ 6 dB
	145 – 149	> 0	≤ 10 dB
	0 – 15	> 0	≤ 5 dB
75RB/100RB	16 – 75	> max(0, RB_End - 15)	≤ 2 dB
and	76 – 120	> 50	≤ 3 dB
100RB/75RB	121 – 160	> 50	≤ 6 dB
	161 – 174	> 0	≤ 10 dB

If the UE is configured to CA_7C and it receives IE CA_NS_06 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows:

$$A\text{-MPR} = CEIL \{M_{A}, 0.5\}$$

Where M_A is defined as follows

$$M_A = -13.33A + 17.5$$
 ; $0 \le A < 0.15$

$$-6.47A + 16.47 \hspace{35pt} ; 0.15 \leq A \leq 1$$

Where $A = N_{RB_alloc} / N_{RB_agg.}$

6.2.4A.7 A-MPR for CA_NS_07

If the UE is configured to CA_39C or any uplink inter-band CA configuration containing CA_39C and it receives IE CA_NS_07 the allowed maximum output power reduction applied to transmission on two component carriers for contiguously aggregated signals is specified in Table 6.2.4A.7-1.

Table 6.2.4A.7-1: Contiguous Allocation A-MPR for CA_NS_07

CA_39C: CA_NS_07	RB _{Start}	LCRB [RBs]	A-MPR for QPSK, 16- QAM and 64- QAM[dB]
	0 – 13	> 0	≤ 11
75 RB / 100 RB	14 – 50	≤ 60	≤ 3
and	14 – 100	> 60	≤ 7
100 RB / 75 RB	101 – 155	> max(155 - RBstart , 0)	≤ 2
	156 – 174	> 0	≤ 5
	0 – 5	> 0	≤ 11
50 DD /400 DD	6 – 42	≤ 25	≤ 3
50 RB / 100 RB and		> 25	≤ 6
100 RB / 50 RB	43 – 80	> 50	≤ 5
100 KB / 50 KB	81 – 138	> 20	≤ 2
	139 – 149	> 0	≤ 5
05 DD /400 DD	0 – 32	≥ 84	≤ 6
25 RB / 100 RB	0 – 32	< 84	≤ 4
and 100 RB / 25 RB	33 – 60	> 50	≤ 3
100 KB / 20 KB	61 – 124	> 20	≤ 3

If the UE is configured to CA_39C or any uplink inter-band CA configuration containing CA_39C and it receives IE CA_NS_07 the allowed maximum output power reduction applied to transmissions on two serving cells assigned to Band 39 with non-contiguous resource allocation is defined as follows

$$A\text{-MPR} = CEIL \{M_{A}, 0.5\}$$

Where MA is defined as follows

$$M_A = \text{-}16.\ 25A + 21 \hspace{1.5cm}; \ 0 \leq A < 0.\ 80$$

$$-2.50 \text{ A} + 10.00$$
 ; $0.80 \le A \le 1$

Where $A = N_{RB_alloc} / N_{RB_agg}$

6.2.4A.8 A-MPR for CA_NS_08

If the UE is configured to CA_42C and it receives IE CA_NS_08 the allowed maximum output power reduction applied to transmission on the PCC and the SCC for contiguously aggregated signals is specified in Table 6.2.4A.8-1.

Table 6.2.4A.8-1: Contiguous Allocation A-MPR for CA_NS_08

CA_42C: CA_NS_08	RBstart	Condition	RBend	L _{CRB} [RBs]	A-MPR for QPSK and 16- QAM[dB]
	≤ 21	Or	≥ 178	≤ 25	≤ 12
	221	Oi	2 170	> 25 and ≤ 80	≤ 6
100RB / 100RB	≥ 0	N/A	N/A	> 80 and ≤ 172	≤ 8
TOURD / TOURD	20	IN/A	IN/A	> 172	≤ 9
	> 21 and ≤ 58	Or	≥ 141 and < 178	< 48	≤3
	> 21	And	< 178	≥ 48 and ≤ 80	≤ 4
	≤ 12	Or	≥ 162	≤ 25	≤ 12
	≤ 12 OI	Oi	≥ 102	> 25 and ≤ 75	≤ 6
100RB / 75RB	≥ 0 N/A	NI/A	N/A N/A	> 75 and <172	≤ 8
And		IN/A		≥172	9
75RB / 100RB	> 12 and ≤ 49	Or	≥ 125 and < 162	< 54	≤3
	> 12	And	< 162	≥ 54 and ≤75	≤ 5
	> 49	And	< 125	≥ 36 and < 54	≤2
75RB / 75RB	≤ 5	Or	≥ 144	≤ 16	≤ 12
and	2.0	Oi	≥ 144	> 16 and ≤ 61	≤ 6
100RB / 50RB	≥ 0	N/A	N/A	> 61	≤8
And	> 5	And	< 144	≥ 36 and ≤ 61	≤ 5
50RB / 100RB	> 5 and ≤ 41	Or	≥ 108 and < 144	< 36	≤3
100RB / 25RB	ORB / 25RB ≤ 31 Or	≥ 92	≤ 34	≤ 4	
And	231	OI	2 92	> 34 and ≤ 44	≤ 5
25RB / 100RB	≥ 0	N/A	N/A	> 44	≤8

- NOTE 1: RB_{start} indicates the lowest RB index of transmitted resource blocks
- NOTE 2: LCRB is the length of a contiguous resource block allocation
- NOTE 3: RB_{end} indicates the highest RB index of transmitted resource blocks
- NOTE 4: If condition is "and" both RB_{start} and RB_{end} constraints need to be met. If condition is "or" either RB_{start} or RB_{end} constraints need to be met
- NOTE 5: For intra-subframe frequency hopping which intersects regions, notes 1, 2, 3 and 4 apply on a per slot basis
- NOTE 6: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe

If the UE is configured to CA_42C and it receives IE CA_NS_08 the allowed maximum output power reduction applied to transmissions on the PCell and the SCell with non-contiguous resource allocation is defined as follows

$$A-MPR = CEIL \{M_{A_1} 0.5\}$$

Where MA is defined as follows

$$\begin{array}{ccc} M_A = & 20 & 0 \leq A < 0.025 \\ & 23 - 120A & 0.025 \leq A < 0.05 \\ & 17.53 - 10.59A & 0.05 \leq A \leq 0.9 \\ & 8 & 0.9 \leq A \leq 1 \end{array}$$

Where $A = N_{RB_alloc} / N_{RB_agg.}$

6.2.4B UE maximum output power with additional requirements for UL-

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the A-MPR values specified in subclause 6.2.4 shall apply to the maximum output power specified in Table 6.2.2B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UE supporting UL-MIMO, the maximum output power is measured as the sum of the maximum output power at each UE antenna connector. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For the UE maximum output power modified by A-MPR, the power limits specified in subclause 6.2.5B apply.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.4 apply.

6.2.4D UE maximum output power with additional requirements for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the allowed A-MPR for the maximum output power for ProSe physical channels PSDCH, PSCCH, PSSCH, and PSBCH shall be as specified in subclause 6.2.4 for PUSCH for the corresponding modulation and transmission bandwidth.

The allowed A-MPR for the maximum output power for ProSe physical signal PSSS and SSSS shall be as be as specified in subclause 6.2.4 for PUSCH QPSK modulation for the corresponding transmission bandwidth.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.2.4D apply for ProSe transmission and the requirements in subclause 6.2.4 apply for uplink transmission.

6.2.4E UE maximum output power with additional requirements for category M1 UE

Additional ACLR and spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power as specified in Table 6.2.2E-1. Unless stated otherwise, an A-MPR of 0 dB shall be used.

For UE Power Class 3 and 5 the specific requirements and identified subclauses are specified in Table 6.2.4E-1 along with the allowed A-MPR values that may be used to meet these requirements. The allowed A-MPR values specified below in Table 6.2.4E-1 and from 6.2.4-2 to 6.2.4-15 are in addition to the allowed MPR requirements specified in subclause 6.2.3E.

Table 6.2.4E-1: Additional Maximum Power Reduction (A-MPR) for category M1 UE

Network Signalling	Requirements (subclause)	E-UTRA Band	Resources Blocks (<i>N</i> _{RB})	A-MPR (dB)
value				
NS_01	6.6.2.1.1	Table 5.5-1	Table 5.6-1	N/A
NS_03	6.6.2.2.1	2, 4	Table 5.6-1	N/A
NS_04	6.6.2.2.2	41	Table 6.	2.4E-3
NS_05	6.6.3.3.1	1	Table 5.6-1	N/A
NS_06	6.6.2.2.3	12, 13	Table 5.6-1	N/A
NS_07	6.6.2.2.3	13	Table 6.	2.4E-4
NS 08	6.6.3.3.2 6.6.3.3.3	19	Table 5.6-1	N/A
NS 09	6.6.3.3.4	21	Table 5.6-1	N/A
NS_10		20	Table 5.6-1	N/A
NS_12	6.6.3.3.5	26	Table 6.	2.4E-5
NS_13	6.6.3.3.6	26	Table 5.6-1	N/A
NS_14	6.6.3.3.7	26	Table 5.6-1	N/A
NS_15	6.6.3.3.8	26	Table 6.2.4-9	
NS_16	6.6.3.3.9	27	Table 5.6-1	N/A
NS_17	6.6.3.3.10	28	Table 5.6-1	N/A
NS_18	6.6.3.3.11	28	Table 5.6-1	N/A
NS_32	-	=	-	-

No other A-MPR requirement than those specified in tables 6.2.4E-1 applies to category M1 UE.

Table 6.2.4E-2: Void

Table 6.2.4E-3: A-MPR for "NS 04" for Cat-M1

Channel bandwidth [Hz]	Parameters	Region
------------------------	------------	--------

	Fc [MHz]	≤ 2500.5	
5	(NB _{index} , RB _{start})	(0, 0-5) (1, 0-1)	
5	LCRB [RBs]	> 0	
	A-MPR [dB]	≤2	
	Fc [MHz]	≤ 2504	
10	(NB _{index} , RB _{start})	(0, 0-5) (1, 0-1)	
10	LCRB [RBs]	>0	
	A-MPR [dB]	≤3	
	Fc [MHz]	≤ 2510.8	
15	(NB _{index} , RB _{start})	(0, 0-5) (1, 0-5)	
13	LCRB [RBs]	>0	
	A-MPR [dB]	≤ 3	
	Fc [MHz]	≤ 2517.5	
20	(NB _{index} , RB _{start})	(0, 0-5) (1, 0-5) (2, 0-5) (3, 0-2)	
20	LCRB [RBs]	>0	
	A-MPR [dB]	≤ 3	

- NOTE 1: RBstart indicates the lowest RB index of transmitted resource blocks
- NOTE 2: LCRB is the length of a contiguous resource block allocation
- NOTE 3: For intra-subframe frequency hopping which intersects regions, notes 1 and 2 apply on a per slot basis
- NOTE 4: For intra-subframe frequency hopping which intersects regions, the larger A-MPR value may be applied for both slots in the subframe
- NOTE 5: For CAT-M1 device, the NB index is the starting index allocated from DCI[6], the RBstart is indexed within the NB allocated to cat-M1 device.

Table 6.2.4E-4: A-MPR for "NS_07" for Cat-M1

BW [MHz]		5			1	0
(NB _{index} ,RB _{start)}	(0,<6)	(0,<6)	(3,<6)	(3,<6)	(0,<6)	(7,<6)
LCRB	>4 and <7	>1 and ≤4	>4 and <7	>1 and ≤4	>2and <7	>2and <7
AMPR [dB]	2	1	2	1	1	1

NOTE 1: NB_{index} is the narrowband index that is defined in 6.2.7 in [4]. The resource block assignment is defined within the narrowband as defined in 5.3.3.1.12 and 5.3.3.1.13 in [5].

Table 6.2.4E-5: A-MPR for "NS_12" for Cat-M1

Channel bandwidth [MHz]	Parameters	Region			
1.4	(NB _{index} , RB _{start})	(0,0)			(0,1-2)
	LCRB [RBs]	≤3	≥4		≥4
	A-MPR [dB]	≤3	≤6		≤3
3	(NB _{index} , RB _{start})		(0	,0-2)	
	LCRB [RBs]			>0	
	A-MPR [dB]] ≤4			
5	(NB _{index} , RB _{start})	(0, 0-5)			
	LCRB [RBs]	>0			
	A-MPR [dB]		≤5		
10	(NB _{index} , RB _{start})	(0, 0-5)	(1, 0)-5)	(2,0-2)
	LCRB [RBs]	>0			
	A-MPR [dB]	≤4			
15 (NB _{index} , RB _{start})			(0-5,0-5)		
	LCRB [RBs]	>0			•
	A-MPR [dB]	≤4			

6.2.4F UE maximum output power with additional requirements for category NB1 UE

Additional ACLR and spectrum emission requirements can be signalled by the network to indicate that the UE shall also meet additional requirements in a specific deployment scenario. To meet these additional requirements, Additional Maximum Power Reduction (A-MPR) is allowed for the output power are specified. For the agreed E-UTRA bands for category NB1 UE an A-MPR of 0 dB shall be allowed unless specified otherwise.

6.2.5 Configured transmitted power

The UE is allowed to set its configured maximum output power $P_{CMAX,c}$ for serving cell c. The configured maximum output power $P_{CMAX,c}$ is set within the following bounds:

 $P_{CMAX_L,c} \leq P_{CMAX,c} \leq P_{CMAX_H,c}$ with

$$P_{CMAX_L,c} = MIN \ \{P_{EMAX,c} - \Delta T_{C,c}, \ P_{PowerClass} - MAX(MPR_c + A-MPR_c + \Delta T_{IB,c} + \Delta T_{C,c} + \Delta T_{ProSe}, P-MPR_c)\}$$

$$P_{CMAX\ H,c} = MIN \{P_{EMAX,c}, P_{PowerClass}\}$$

where

- $P_{EMAX,c}$ is the value given by IE *P-Max* for serving cell *c*, defined in [7];
- P_{PowerClass} is the maximum UE power specified in Table 6.2.2-1 without taking into account the tolerance specified in the Table 6.2.2-1;
- MPR $_c$ and A-MPR $_c$ for serving cell c are specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- $\Delta T_{IB,c}$ is the additional tolerance for serving cell c as specified in Table 6.2.5-2; $\Delta T_{IB,c} = 0$ dB otherwise;
- $\Delta T_{C,c} = 1.5$ dB when NOTE 2 in Table 6.2.2-1 applies;
- $\Delta T_{C,c} = 0$ dB when NOTE 2 in Table 6.2.2-1 does not apply;
- $\Delta T_{ProSe} = 0.1$ dB when the UE supports ProSe Direct Discovery and/or ProSe Direct Communication on the corresponding E-UTRA ProSe band; $\Delta T_{ProSe} = 0$ dB otherwise.

P-MPR $_c$ is the allowed maximum output power reduction for

- a) ensuring compliance with applicable electromagnetic energy absorption requirements and addressing unwanted emissions / self desense requirements in case of simultaneous transmissions on multiple RAT(s) for scenarios not in scope of 3GPP RAN specifications;
- b) ensuring compliance with applicable electromagnetic energy absorption requirements in case of proximity detection is used to address such requirements that require a lower maximum output power.

The UE shall apply P-MPR $_c$ for serving cell c only for the above cases. For UE conducted conformance testing P-MPR shall be $0~\mathrm{dB}$

- NOTE 1: P-MPR $_c$ was introduced in the $P_{CMAX,c}$ equation such that the UE can report to the eNB the available maximum output transmit power. This information can be used by the eNB for scheduling decisions.
- NOTE 2: P-MPR_c may impact the maximum uplink performance for the selected UL transmission path.

For each subframe, the $P_{CMAX_L,c}$ for serving cell c is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum $P_{CMAX_L,c}$ over the two slots is then applied for the entire subframe. $P_{PowerClass}$ shall not be exceeded by the UE during any period of time.

The measured configured maximum output power P_{UMAX,c} shall be within the following bounds:

$$P_{CMAX_L,c} - \ MAX\{T_{L,c}, T(P_{CMAX_L,c})\} \ \leq \ P_{UMAX,c} \ \leq \ P_{CMAX_H,c} + \ T(P_{CMAX_H,c}).$$

where the tolerance $T(P_{CMAX,c})$ for applicable values of $P_{CMAX,c}$ is specified in Table 6.2.5-1, and Table 6.2.5-1A. The tolerance $T_{L,c}$ is the absolute value of the lower tolerance for the applicable operating band as specified in Table 6.2.2-1.

Table 6.2.5-1: P_{CMAX} tolerance

P _{CMAX,c} (dBm)	Tolerance T(P _{CMAX,c}) (dB)
23 < P _{CMAX,c} ≤ 33	2.0
21 ≤ P _{CMAX,c} ≤ 23	2.0
20 ≤ P _{CMAX,c} < 21	2.5
19 ≤ P _{CMAX,c} < 20	3.5
18 ≤ P _{CMAX,c} < 19	4.0
13 ≤ P _{CMAX,c} < 18	5.0
8 ≤ P _{CMAX,c} < 13	6.0
-40 ≤ P _{CMAX,c} < 8	7.0

Table 6.2.5-1A: P_{CMAX} tolerance for power class 5

P _{CMAX,c} (dBm)	Tolerance T(Pcmax,c) (dB)
$P_{CMAX,c} = 20$	2.0
19 ≤ P _{CMAX,c} < 20	3.5
18 ≤ P _{CMAX,c} < 19	4.0
13 ≤ P _{CMAX,c} < 18	5.0
8 ≤ P _{CMAX,c} < 13	6.0
-40 ≤ P _{CMAX,c} < 8	7.0

For the UE which supports inter-band carrier aggregation configurations with the uplink assigned to one or two E-UTRA bands the $\Delta T_{IB,c}$ is defined for applicable bands in Table 6.2.5-2, Table 6.2.5-3 and Table 6.2.5-4.

Table 6.2.5-2: ΔT_{IB,c} (two bands)

Inter-band CA Configuration	E-UTRA Band	ΔT _{IB,c} [dB]
CA_1A-3A	1	0.3
0/(_1/(0/(3	0.3
CA_1A-3C	1	0.3
	3	0.3
CA_1A-5A	5	0.3
	1	0.5
CA_1A-7A	7	0.6
CA 1A 7C	1	0.5
CA_1A-7C	7	0.6
CA_1A-8A	1	0.3
	8	0.3
CA_1A-11A	1	0.3
	11	0.3
CA_1A-18A	18	0.3
24 44 424	1	0.3
CA_1A-19A	19	0.3
CA 1A 20A	1	0.3
CA_1A-20A	20	0.3
CA_1A-21A	1	0.3
J	21	0.3
CA_1A-26A	1	0.3
_	26	0.3
CA_1A-28A	28	0.3 0.6
	1	0.5
CA_1A-40A	40	0.5
00.40.4408	1	0.5
CA_1A-41A ⁸	41	0.5
CA_1A-41C ⁸	1	0.5
CA_1A-41C	41	0.5
CA_1A-42A	1	0.3
_	42	0.8
CA_1A-42C	1 42	0.3 0.8
CA_1A-46A	1	0.8
	2	0.5
CA_2A-4A	4	0.5
CA 2A 2A 4A	2	0.5
CA_2A-2A-4A	4	0.5
CA_2A-4A-4A	2	0.5
_	4	0.5
CA_2A-2A-4A-	2 4	0.5
4A	2	0.5 0.3
CA_2A-5A	5	0.3
04 04 04	2	0.3
CA_2A-2A-5A	5	0.3
CA_2C-5A	2	0.3
UA_2U*UA	5	0.3
CA_2A-7A	2	0.5
	7	0.5
CA_2A-12A	12	0.3 0.3
	2	0.3
CA_2A-2A-12A	12	0.3
OA OA OA 105	2	0.3
CA_2A-2A-12B	12	0.3
CA_2A-12B	2	0.3
O/_Z/\-1ZD	12	0.3

CA_2C-12A	2	0.3
UA_20-12A	12	0.3
	2	0.3
CA_2A-13A	13	0.3
CA_2A-2A-13A	2	0.3
07 (<u></u>	13	0.3
00 00 470	2	0.3
CA_2A-17A	17	0.8
	2	0.3
CA_2A-28A		
	28	0.3
CA_2A-29A	2	0.3
CA_2C-29A	2	0.3
	2	0.5
CA_2A-30A	30	0.3
CA_2C-30A	2	0.5
	30	0.3
CA_2A-46A	2	0
	3	0.3
CA_3A-5A	5	0.3
CA_3C-5A	3	0.3
<u> </u>	5	0.3
04 04 =:	3	0.5
CA_3A-7A	7	0.5
	3	
CA_3A-7B		0.5
- ·	7	0.5
CA 2A 7C	3	0.5
CA_3A-7C	7	0.5
	3	0.5
CA_3C-7A		
	7	0.5
CA_3C-7C	3	0.5
CA_3C-7C	7	0.5
	3	0.3
CA_3A-8A	8	0.3
CA_3A-3A-8A	3	0.3
071_071 071 071	8	0.3
04 04 404	3	0.3
CA_3A-19A	19	0.3
	3	0.3
CA_3A-20A		
<u>-</u>	20	0.3
CA_3A-26A	3	0.3
CA_3A-20A	26	0.3
	3	0.3
CA_3A-27A	27	0.3
CA_3A-28A	3	0.3
J J. (20/ (28	0.3
04 00 004	3	0.3
CA_3C-28A	28	0.3
	3	0.3
CA_3A-31A		
	31	0.6
CA_3A-38A	3	0,5
O/20/4-20/4	38	0,5
	3	0.5
CA_3A-40A	40	0.5
CA_3A-40C	3	0.5
CC. (100	40	0.5
	3	0.5
CA_3A-41A		0.310
OA_3A-41A	41	0.8 ¹¹
04 54 115	3	0.5
CA_3A-41C	41	0.310
		0.8 ¹¹
04 04 15 1	3	0.6
CA_3A-42A	42	0.8
CA_3A-42C	3	0.6
	42	0.8
L_		

CA_3A-46A	3	0
	4	0.3
CA_4A-5A —	5	0.3
CA_4A-4A-5A	4	0.3
UA_4A-4A-3A	5	0.3
CA_4A-7A	4	0.5
0/_1/\ //\	7	0.5
CA_4A-4A-7A	4	0.5
*	7	0.5
CA_4A-12A	4	0.3
	12	0.8
CA_4A-4A-12A	<u>4</u> 12	0.3 0.8
	4	0.3
CA_4A-12B —	12	0.8
	4	0.3
CA_4A-13A —	13	0.3
01 11 101	4	0.3
CA_4A-4A-13A	13	0.3
CA 4A 47A	4	0.3
CA_4A-17A	17	0.8
CA_4A-27A —	4	0.3
UA_4A-21A	27	0.3
CA_4A-28A	4	0.3
	28	0.6
CA_4A-29A	4	0.3
CA_4A-4A-29A	4	0.3
CA_4A-30A	4	0.5
0.1	30	0.3
CA_4A-4A-30A —	4	0.5
	30	0.3
CA_4A-46A	4	0
CA_5A-7A —	<u> </u>	0.3
	5	0.3 0.8
CA_5A-12A —	12	0.4
	5	0.8
CA_5A-12B	12	0.4
04 54 404	5	0.5
CA_5A-13A	13	0.5
00 50 470	5	0.8
CA_5A-17A	17	0.4
CA_5A-25A	5	0.3
	25	0.3
CA_5A-29A	5	0.5
CA_5A-30A	5	0.3
5.1_5.1.00/1	30	0.3
CA_5A-38A	5	0.3
	38	0.3
CA_5A-40A	5	0.3
	40	0.3
CA_5A-40C	5	0.3
	40	0.3
CA_7A-8A	7 8	0.3 0.6
	8 7	0.8
CA_7A-12A	12	0.3
21	7	0.3
CA_7A-20A	20	0.3
04 74 004	7	0.5
CA_7A-22A	22	0.8
CA 74 004	7	0.3
CA_7A-28A —	28	0.3
CA_7B-28A	7	0.3
UA_1 D-20A	28	0.3
	-	

CA_7C-28A 7 0.3 CA_7A-40A 7 0.5 CA_7A-40C 7 0.5 CA_7A-40C 40 [0.6] CA_7A-42A 7 0.5 CA_7A-42A- 42 0.8 CA_7A-46A 7 0.5 CA_8A-11A 11 0.4 CA_8A-20A 8 0.3 CA_8A-40A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41C 8 0.3 CA_8A-42A 8 0.3 CA_8A-42C 8 0.6 CA_8A-42C 8 0.6 CA_8A-42C 8 0.6 CA_8A-42C 0.8 0.6	
CA_7A-40A 7 0.5 CA_7A-40C 7 0.5 CA_7A-42A 7 0.5 CA_7A-46A 7 0.8 CA_8A-11A 11 0.4 CA_8A-20A 8 0.3 CA_8A-40A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41C 8 0.6 CA_8A-42C 8 0.6 CA_8A-42C 8 0.6	
CA_7A-40A 40 [0.6] CA_7A-40C 7 0.5 CA_7A-42A 7 0.5 CA_7A-42A 42 0.8 CA_7A-42A- 7 0.5 42A 42 0.8 CA_7A-46A 7 0 CA_8A-11A 11 0.4 CA_8A-20A 8 0.4 CA_8A-20A 20 0.4 CA_8A-40A 40 0.3 CA_8A-41A 41 0.3 CA_8A-41A 41 0.3 CA_8A-41C 41 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6	
CA_7A-40C 7 0.5 CA_7A-42A 7 0.5 CA_7A-42A 42 0.8 CA_7A-42A- 7 0.5 42A 42 0.8 CA_7A-46A 7 0 CA_8A-11A 11 0.4 CA_8A-20A 8 0.4 CA_8A-20A 8 0.3 CA_8A-40A 8 0.3 CA_8A-41A 41 0.3 CA_8A-41C 8 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6	
CA_7A-40C 40 [0.6] CA_7A-42A 7 0.5 CA_7A-42A- 7 0.5 42A 42 0.8 CA_7A-46A 7 0 CA_8A-11A 11 0.4 CA_8A-20A 8 0.4 CA_8A-20A 20 0.4 CA_8A-40A 8 0.3 CA_8A-41A 40 0.3 CA_8A-41A 41 0.3 CA_8A-41C 41 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6	
CA_7A-42A 7 0.5 CA_7A-42A- 7 0.5 42A 42 0.8 CA_7A-46A 7 0 CA_8A-11A 11 0.4 CA_8A-20A 8 0.3 CA_8A-40A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41C 8 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6	
CA_7A-42A 42 0.8 CA_7A-42A- 7 0.5 42A 42 0.8 CA_7A-46A 7 0 CA_8A-11A 11 0.4 CA_8A-20A 8 0.4 CA_8A-20A 20 0.4 CA_8A-40A 8 0.3 CA_8A-41A 40 0.3 CA_8A-41A 41 0.3 CA_8A-41C 41 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6	
CA_7A-42A- 7 0.5 42A 42 0.8 CA_7A-46A 7 0 CA_8A-11A 8 0.3 CA_8A-20A 8 0.4 CA_8A-40A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41C 8 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6	
42A 42 0.8 CA_7A-46A 7 0 CA_8A-11A 8 0.3 CA_8A-20A 8 0.4 CA_8A-20A 8 0.3 CA_8A-40A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41C 8 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6	
CA_7A-46A 7 0 CA_8A-11A 8 0.3 CA_8A-20A 8 0.4 CA_8A-40A 20 0.4 CA_8A-40A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41C 8 0.3 CA_8A-42A 8 0.3 CA_8A-42C 8 0.6 CA_8A-42C 8 0.6	
CA_8A-11A 8 0.3 CA_8A-20A 8 0.4 CA_8A-20A 20 0.4 CA_8A-40A 8 0.3 CA_8A-41A 40 0.3 CA_8A-41A 41 0.3 CA_8A-41C 8 0.3 CA_8A-42A 41 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6	
CA_8A-11A 11 0.4 CA_8A-20A 8 0.4 CA_8A-40A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41C 8 0.3 CA_8A-42A 8 0.3 CA_8A-42C 8 0.6 CA_8A-42C 8 0.6	
CA_8A-20A	
CA_8A-20A 20 0.4 CA_8A-40A 8 0.3 CA_8A-41A 8 0.3 CA_8A-41C 8 0.3 CA_8A-42A 41 0.3 CA_8A-42C 8 0.6 CA_8A-42C 8 0.6 CA_8A-42C 8 0.6	
CA_8A-40A	
CA_8A-40A 40 0.3 CA_8A-41A 8 0.3 CA_8A-41C 8 0.3 CA_8A-41C 41 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6 CA_8A-42C 8 0.6	
CA_8A-41A 8 0.3 CA_8A-41C 8 0.3 CA_8A-41C 41 0.3 CA_8A-42A 8 0.6 CA_8A-42A 42 0.8 CA_8A-42C 8 0.6	
CA_8A-41A 41 0.3 CA_8A-41C 8 0.3 CA_8A-42A 41 0.3 CA_8A-42A 8 0.6 CA_8A-42C 8 0.6	
CA_8A-42C 8 0.3 CA_8A-42C 8 0.3 CA_8A-42C 8 0.6 CA_8A-42C 8 0.6	
CA_8A-42A	
CA_8A-42C 8 0.6 CA_8A-42C 8 0.6	
CA_8A-42A 42 0.8 CA_8A-42C 8 0.6	
CA 8A-42C 8 0.6	
(.A 8A-47).	
1.A 8A-471.	
1 1- 1 0:0	_
11 0.3	
CA_11A-18A	
12 0.3	
CA_12A-25A 25 0.3	
12 0.3	
CA_12A-30A 30 0.3	
18 0.5	
CA_18A-28A ⁹ 28 0.5	
10 0.3	
CA_19A-21A 21 0.3	_
10 0.5	
CA_19A-28A ⁹ 28 0.5	
19 0.3	
CA_19A-42A 42 0.8	
19 0.3	
CA_19A-42C 42 0.8	
20 0.5	
CA_20A-31A 31 0.5	
CA 20A-32A 20 0.3	
20 0.3	
LA ZUA-38A	
38 0.3	
(.A 20A-40A	
40 0.3	
CA_20A-42A 20 0.6	
42 0.8	
CA_20A-42A- 20 0.6	
42A 42 0.8	
CA_20A-67A 20 0.5	
CA_21A-42A 21 0.4	
42 0.8	
CA_21A-42C 21 0.4	
42 0.8	
CA_23A-29A 23 0.3	
CA_25A-26A 25 0.3	
26 0.3	
CA_25A-41A ⁸ 25 0.5	
41 0.5	
CA_25A-41C ⁸ 25 0.5	
41 0.5	
CA_25A-41D ⁸ 25 0.5	

	41	0.5
CA_26A-41A	26	0.3
O/(_20/(+1/(41	0.3
CA_26A-41C	26	0.3
	41	0.3
CA_28A-40A	28	0.3
CA_20A-40A	40	0.3
CA_28A-40C	28	0.3
CA_20A-40C	40	0.3
CA_28A-40D	28	0.3
CA_26A-40D	40	0.3
CA 20A 44A	28	0.3
CA_28A-41A	41	0.3
CA 20A 44C	28	0.3
CA_28A-41C	41	0.3
CA 20A 40A	28	0.5
CA_28A-42A	42	0.8
04 004 400	28	0.5
CA_28A-42C	42	0.8
CA 29A-30A	30	0.3
	38	04
CA_38A-40A	40	04
CA_38A-40A-	38	04
40A	40	04
	38	04
CA_38A-40C	40	04
	39	04
CA_39A-41A	41	04
	39	0.57
CA_39A-41A	41	0.57
	39	04
CA_39A-41C	41	04
	39	0.57
CA_39A-41C	41	0.57
	39	04
CA_39A-41D	41	04
	39	04
CA_39C-41A	41	04
	39	0.57
CA_39C-41A	41	0.57
	39	04
CA_39C-41C	41	04
	41	04
CA_41A-42A	42	0.54
	41	0.3
CA_41A-42C	42	0.54
	41	0.3
CA_41C-42A	42	0.54
		0.5
CA_41C-42C	41 42	0.54
CA 44 A 46 A	42	
CA_41A-46A		0
CA_42A-46A	42	[0.5]

NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations

NOTE 2: The above additional tolerances also apply in non-aggregated operation for the supported E-UTRA operating bands that belong to the supported interband carrier aggregation configurations

NOTE 3: In case the UE supports more than one of the above 2DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 2DL inter-band carrier aggregation configurations then:

- When the E-UTRA operating band frequency range is \leq 1GHz, the applicable additional tolerance shall be the average of the 2DL tolerances above, truncated to one decimal place for that operating band among the supported 2DL CA configurations. In case there is a harmonic relation

- between low band UL and high band DL, then the maximum tolerance among the different supported 2DL carrier aggregation configurations involving such band shall be applied
- When the E-UTRA operating band frequency range is >1GHz, the applicable additional 2DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 2DL CA configurations
- NOTE 4: Only applicable for UE supporting inter-band carrier aggregation with uplink in one E-UTRA band and without simultaneous Rx/Tx.
- NOTE 5: Unless otherwise specified, in case the UE supports more than one of the above 3DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 3DL inter-band carrier aggregation configurations then:
 - When the E-UTRA operating band frequency range is ≤ 1GHz and the tolerances are the same, the value applies to the band. If the tolerances are different, the applicable additional 3DL tolerance is FFS. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 3DL carrier aggregation configurations involving such band shall be applied
 - When the E-UTRA operating band frequency range is >1GHz, the applicable additional 3DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 3DL CA configurations.
- NOTE 6: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.
- NOTE 7: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx.
- NOTE 8: Only applicable for UE supporting inter-band carrier aggregation with the uplink active in the FDD band.
- NOTE 9: For Band 28, the requirements only apply for the restricted frequency range specified for this CA configuration (Table 5.5A-2).
- NOTE 10: The requirement is applied for UE transmitting on the frequency range of 2545-2690MHz.
- NOTE 11: The requirement is applied for UE transmitting on the frequency range of 2496-2545MHz.
- NOTE 12: For UE supporting E-UTRA band 65 and CA configurations including Band 1, the Band 65 $\Delta T_{IB,c}$ is the max(Band 65 $\Delta T_{IB,c}$, Band 1 $\Delta T_{IB,c}$)
- NOTE: The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and another band is >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.
- NOTE: To meet the $\Delta T_{IB,c}$ requirements for CA_3A-7A with state-of-the-art technology, an increase in power consumption of the UE may be required. It is also expected that as the state-of-the-art technology evolves in the future, this possible power consumption increase can be reduced or eliminated.

Table 6.2.5-3: $\Delta T_{IB,c}$ (three bands)

Inter-band CA Configuration	E-UTRA Band	ΔT _{IB,c} [dB]
	1	0.6
CA_1A-3A-7A	3	0.6
_	7	0.6
	1	0.6
CA_1A-3A-7C	3	0.6
<i>5,</i> (<u>−</u> ,, <i>t 5, t T 6</i>	7	0.6
	1	0.3
CA_1A-3A-8A	3	0.3
0A_1A-3A-0A	8	0.3
	1	0.3
CA_1A-3A-5A	3	0.3
CA_TA-SA-SA	5	
		0.3
04 44 04 404	1	0.3
CA_1A-3A-19A	3	0.3
	19	0.3
	1	0.3
CA_1A-3A-20A	3	0.3
	20	0.3
	1	0.3
CA_1A-3A-26A	3	0.3
	26	0.3
	1	0.3
CA_1A-3A-28A	3	0.3
	28	0.6
	1	0.5
CA_1A-3A-40A	3	0.5
O/(_1/\ 0/\ 40/\	40	0.5
	1	0.6
CA 1A 2A 12A	·	
CA_1A-3A-42A	3	0.6
	42	0.8
	1	0.6
CA_1A-3A-42C	3	0.6
	42	0.8
	1	0.5
CA_1A-5A-7A	5	0.3
	7	0.6
	1	0.5
CA_1A-5A-40A	5	0.3
	40	0.5
	1	0.5
CA_1A-7A-8A	7	0.6
_	8	0.6
	1	0.5
CA_1A-7A-20A	7	0.6
	20	0.3
	1	0.5
CA_1A-7A-28A	7	0.6
ON_IN-IN-20A	28	
		0.6
CA 4A 7C 00A	1	0.5
CA_1A-7C-28A	7	0.6
	28	0.6
CA_1A-8A-11A	1	0.3
	8	0.3
	11	0.4
	1	0.5
CA_1A-8A-40A	8	0.3
5 5		
	40	0.5
	40 1	0.5
CA_1A-11A-18A		
CA_1A-11A-18A	1	0.3

		1
	18	0.5
	28	0.5
	11	0.3
CA_1A-19A-21A	19	0.3
	21	0.4
	1	0.3
CA_1A-19A-28A	19	0.5
	28	0.5
	1	0.3
CA 1A-19A-42A	19	0.3
	42	0.8
	1	0.3
CA_1A-19A-42C	19	0.3
	42	0.8
	<u></u> 1	0.3
CA_1A-21A-42A	21	0.4
O/(_//\ 21/\ 42/\	42	0.8
	1	
	•	0.3
CA_1A-21A-42C	21	0.4
	42	0.8
	2	0.5
CA_2A-2A-4A-12A	4	0.5
	12	0.8
	2	0.5
CA_2A-4A-5A	4	0.5
	5	0.3
	2	0.5
CA_2A-2A-4A-5A	4	0.5
	5	0.3
	2	0.5
CA_2A-4A-4A-5A	4	0.5
	5	0.3
	2	0.5
CA_2A-4A-7A	4	0.5
O/(_Z/(4/(//(7	0.5
	2	0.5
CA_2A-4A-12A	4	0.5
CA_2A-4A-12A	4 12	
	2	0.8
CA 2A 4A 4A 12A		0.5
CA_2A-4A-4A-12A	4	0.5
	12	0.8
	2	0.5
CA_2A-4A-13A	4	0.5
	13	0.3
CA_2A-4A-29A	2	[0.5]
	4	0.5
	2	0.5
CA_2A-4A-30A	4	0.5
	30	0.3
	2	0.3
CA_2A-5A-12A	5	0.8
	12	0.4
	2	0.3
CA_2A-2A-5A-12A	5	0.8
	12	0.4
	2	0.3
CA_2A-5A-12B	5	0.8
	12	0.4
	2	0.4
CA_2A-5A-13A	5	0.5
UA_2A-3A-13A		
	13	0.5
CA_2A-5A-29A	2	0.3
	5	0.5
CA_2A-5A-30A	2	0.5
	5	0.3

		2.2
	30	0.3
CA_2C-5A-30A	2	0.5
	5	0.3
	30	0.3
CA_2A-7A-12A	2	0.5
	7	0.5
_	12	0.3
	2	0.5
CA_2A-12A-30A	12	0.3
0A_2A-12A-30A		
	30	0.3
	2	0.5
CA 2C 42A 20A		
CA_2C-12A-30A	12	0.3
	30	0.3
	2	0.5
CA_2A-29A-30A		
	30	0.3
	2	0.5
CA_2C-29A-30A		
	30	0.3
	3	0.5
CA 2A EA 40A	5	0.3
CA_3A-5A-40A		
	40	0.5
	3	0.5
CA_3A-7A-8A	7	0.5
	8	0.6
	3	0.5
CA_3A-7A-20A	7	0.5
_	20	0.3
	3	0.5
CA_3A-7A-28A	7	0.5
G/(_G/(//(26/(
	28	0.3
	3	0.5
CA_3A-7C-28A	7	0.5
CA_5A-7C-26A		
	28	0.3
	3	0.5
CA 2C 7A 20A		
CA_3C-7A-28A	7	0.5
	28	0.3
	3	0.5
04 00 70 004		
CA_3C-7C-28A	7	0.5
	28	0.3
	3	0.5
04 04 74 004	<u>3</u>	
CA_3A-7A-38A	7	0.5
	38	0.5
	3	0.5
CA_3A-8A-40A	8	0.3
	40	
		0.5
	3	0.6
CA_3A-19A-42A	19	0.3
	42	0.8
	3	0.6
CA_3A-19A-42C	19	0.3
J J. (1 J. (- 72 J		
	42	0.8
	3	0.5
CA_3A-28A-40A	28	0.3
UA_3A-20A-40A		
	40	0.5
	3	0.5
CV 3V-38V 40C	28	
CA_3A-28A-40C		0.3
	40	0.5
	3	1
CA 2A 44 A 42 A 8		·
CA_3A-41A-42A ⁸	41	0.35/0.86
	42	0.8
	4	0.3
00 40 50 400		
CA_4A-5A-12A	5	0.8
[12	0.8
	4	0.3
0 4 4 4 5 6 4 6 5		
CA_4A-4A-5A-12A	5	0.8
	12	0.8
	·-	<u> </u>

	4	0.3
CA_4A-5A-13A	5	0.5
	13	0.5
CA 44 54 204	4	0.3
CA_4A-5A-29A	5	0.5
	4	0.5
CA_4A-5A-30A	5	0.3
	30	0.3
	4	0.5
CA_4A-4A-5A-30A	5	0.3
	30	0.3
	4	0.5
CA_4A-7A-12A	7	0.5
	12	0.8
	4	0.5
CA_4A-12A-30A	12	0.8
	30	0.3
	4	0.5
CA_4A-4A-12A-30A	12	0.8
	30	0.3
CA 4A 20A 20A	4	0.5
CA_4A-29A-30A	30	0.3
CA_4A-4A-29A-30A	4	0.5
CA_4A-4A-29A-30A	30	0.3
	7	0.3
CA_7A-8A-20A	8	0.6
	20	[0.6]
	7	0.3
CA_7A-20A-38A	20	0.3
	38	0.3
	19	0.3
CA_19A-21A-42A	21	0.4
	42	0.8
	19	0.3
CA_19A-21A-42C	21	0.4
	42	0.8

- NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations
- NOTE 2: The above additional tolerances also apply in non-aggregated operation for the supported E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations
- NOTE 3: Unless otherwise specified, in case the UE supports more than one of the above 3DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 3DL inter-band carrier aggregation configurations then:
 - When the E-UTRA operating band frequency range is ≤ 1GHz and the tolerances are the same, the value applies to the band. If the tolerances are different, the applicable additional 3DL tolerance is FFS. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 3DL carrier aggregation configurations involving such band shall be applied
 - When the E-UTRA operating band frequency range is >1GHz, the applicable additional 3DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 3DL CA configurations
- NOTE 4: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order interband carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.
- NOTE 5: The requirement is specified for the frequency range of 2545-2690MHz.
- NOTE 6: The requirement is specified for the frequency range of 2496-2545MHz.

- NOTE 7: For UE supporting E-UTRA band 65 and CA configurations including Band 1, the Band 65 $\Delta T_{IB,c}$ is the max(Band 65 $\Delta T_{IB,c}$, Band 1 $\Delta T_{IB,c}$)
- NOTE 8: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among TDD bands.

Table 6.2.5-4: ΔT_{IB,c} (four bands)

Inter-band CA Configuration	E-UTRA Band	ΔT _{IB,c} [dB]
	1	0.5
CA_1A-3A-5A-40A	3	0.5
CA_1A-3A-3A-40A	5	0.3
	40	0.5
	1	0.6
CA_1A-3A-7A-8A	3	0.6
CA_1A-3A-1A-0A	7	0.6
	8	0.6
	1	0.6
CA_1A-3A-7A-28A	3	0.6
0A_1A-3A-1A-20A	7	0.6
	28	0.6
	1	0.6
CA_1A-3A-7C-28A	3	0.6
CA_1A-3A-7C-26A	7	0.6
	28	0.6
	1	0.5
CA 1A 2A 8A 40A	3	0.5
CA_1A-3A-8A-40A	8	0.3
	40	0.5
	1	0.6
	3	0.6
CA_1A-3A-19A-42A	19	0.3
	42	0.8
	1	0.6
 	3	0.6
CA_1A-3A-19A-42C —	19	0.3
 	42	0.8
	1	0.3
 	19	0.3
CA_1A-19A-21A-42A —	21	0.3
 	42	0.8
+	4 <u>z</u>	0.3
 	19	0.3
CA_1A-19A-21A-42C —	21	
 		0.4
	42	0.8
<u> </u>	2	0.5
CA_2A-4A-5A-12A —	4	0.5
<u> </u>	5	0.8
	12	0.8
OA OA 44 54 00A	2	0.5
CA_2A-4A-5A-29A	4	0.5
	5	0.5
	2	0.5
CA_2A-4A-5A-30A	4	0.5
_	5	0.3
	30	0.3
	2	0.5
CA_2A-4A-7A-12A	4	0.5
	7	0.5
	12	0.8
	2	0.5
CA_2A-4A-12A-30A	4	0.5
J. Z. C T. C 12/1-00/A	12	0.8
	30	0.3
	2	0.5
CA_2A-4A-29A-30A	4	0.5
	30	0.3

NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

NOTE 2: The above additional tolerances also apply in non-aggregated operation for

the supported E-UTRA operating bands that belong to the supported interband carrier aggregation configurations.

NOTE 3: Tolerances for a UE supporting multiple 4DL inter-band CA configurations

NOTE 4: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.

NOTE 5: For UE supporting E-UTRA band 65 and CA configurations including Band 1, the Band 65 $\Delta T_{IB,c}$ is the max(Band 65 $\Delta T_{IB,c}$, Band 1 $\Delta T_{IB,c}$)

NOTE: The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and other bands are >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

6.2.5A Configured transmitted power for CA

For uplink carrier aggregation the UE is allowed to set its configured maximum output power $P_{CMAX,c}$ for serving cell c and its total configured maximum output power P_{CMAX} .

The configured maximum output power $P_{CMAX,c}$ on serving cell c shall be set as specified in subclause 6.2.5.

For uplink inter-band carrier aggregation, MPR_c and A-MPR_c apply per serving cell c and are specified in subclause 6.2.3 and subclause 6.2.4, respectively. P-MPR_c accounts for power management for serving cell c. P_{CMAX,c} is calculated under the assumption that the transmit power is increased independently on all component carriers.

For uplink intra-band contiguous and non-contiguous carrier aggregation, MPR $_c$ = MPR and A-MPR $_c$ = A-MPR with MPR and A-MPR specified in subclause 6.2.3A and subclause 6.2.4A respectively. There is one power management term for the UE, denoted P-MPR, and P-MPR $_c$ = P-MPR. $_{CMAX,c}$ is calculated under the assumption that the transmit power is increased by the same amount in dB on all component carriers.

The total configured maximum output power P_{CMAX} shall be set within the following bounds:

$$P_{CMAX L} \leq P_{CMAX} \leq P_{CMAX H}$$

For uplink inter-band carrier aggregation with one serving cell c per operating band,

 $P_{CMAX_L} = MIN \; \{ 10log_{10} \sum MIN \; [\; p_{EMAX,c} / \; (\Delta t_{C,c}), \; \; p_{PowerClass} / (mpr_c \cdot a - mpr_c \cdot \Delta t_{C,c} \cdot \Delta t_{IB,c} \cdot \Delta t_{ProSe}) \; , \; p_{PowerClass} / pmpr_c], \; P_{PowerClass} \}$

$$P_{CMAX_H} = MIN\{10 \ log_{10} \sum p_{EMAX,c} \,, \, P_{PowerClass}\}$$

where

- $p_{EMAX,c}$ is the linear value of $P_{EMAX,c}$ which is given by IE *P-Max* for serving cell c in [7];
- P_{PowerClass} is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1; p_{PowerClass} is the linear value of P_{PowerClass};
- mpr c and a-mpr c are the linear values of MPR c and A-MPR c as specified in subclause 6.2.3 and subclause 6.2.4, respectively;
- pmpr_c is the linear value of P-MPR_c;
- $\Delta t_{C,c}$ is the linear value of $\Delta T_{C,c}$. $\Delta t_{C,c} = 1.41$ when NOTE 2 in Table 6.2.2-1 applies for a serving cell c, otherwise $\Delta t_{C,c} = 1$;
- $\Delta t_{IB,c}$ is the linear value of the inter-band relaxation term $\Delta T_{IB,c}$ of the serving cell c as specified in Table 6.2.5-2; otherwise $\Delta t_{IB,c} = 1$;

- Δt_{ProSe} is the linear value of ΔT_{ProSe} and applies as specified in subclause 6.2.5.

For uplink intra-band contiguous and non-contiguous carrier aggregation,

$$\begin{split} P_{CMAX_L} &= MIN\{10 \ log_{10} \sum p_{EMAX,c} \ -\Delta T_C \ , P_{PowerClass} - MAX(MPR + A-MPR + \Delta T_{IB,c} + \Delta T_C + \Delta T_{ProSe}, P-MPR \) \ \} \\ &P_{CMAX_H} &= MIN\{10 \ log_{10} \sum p_{EMAX,c} \ , P_{PowerClass}\} \end{split}$$

where

- $p_{\text{EMAX},c}$ is the linear value of $P_{\text{EMAX},c}$ which is given by IE *P-Max* for serving cell *c* in [7];
- P_{PowerClass} is the maximum UE power specified in Table 6.2.2A-1 without taking into account the tolerance specified in the Table 6.2.2A-1;
- MPR and A-MPR are specified in subclause 6.2.3A and subclause 6.2.4A respectively;
- $\Delta T_{IB,c}$ is the additional tolerance for serving cell c as specified in Table 6.2.5-2;
- P-MPR is the power management term for the UE;
- ΔT_C is the highest value $\Delta T_{C,c}$ among all serving cells c in the subframe over both timeslots. $\Delta T_{C,c} = 1.5$ dB when NOTE 2 in Table 6.2.2A-1 applies to the serving cell c, otherwise $\Delta T_{C,c} = 0$ dB;
- ΔT_{ProSe} applies as specified in subclause 6.2.5.

For combinations of intra-band and inter-band carrier aggregation with UE configured for transmission on three serving cells (up to two contiguously aggregated carriers per operating band),

$$\begin{split} P_{CMAX_L} &= MIN \; \{10log_{10} \sum (p_{CMAX_L, \; Bi}), \; P_{PowerClass} \} \\ \\ P_{CMAX_H} &= MIN \{10 \; log_{10} \; \sum p_{EMAX,c} \; , \; P_{PowerClass} \} \end{split}$$

where

- $p_{EMAX,c}$ is the linear value of $P_{EMAX,c}$ which is given by IE *P-Max* for serving cell *c* in [7];
- P_{PowerClass} is the maximum UE power specified in Table 6.2.2A-0 without taking into account the tolerance specified in the Table 6.2.2A-0; p_{PowerClass} is the linear value of P_{PowerClass};
- p_{CMAX_L, Bi} is the linear values of P_{CMAX_L} as specified in corresponding operating band. P_{CMAX_L,c} specified for single carrier in subclause 6.2.5 applies for operating band supporting one serving cell. P_{CMAX_L} specified for uplink intra-band contiguous carrier aggregation in subclause 6.2.5A applies for operating band supporting two contiguous serving cells.

For each subframe, the P_{CMAX_L} is evaluated per slot and given by the minimum value taken over the transmission(s) within the slot; the minimum P_{CMAX_L} over the two slots is then applied for the entire subframe. $P_{PowerClass}$ shall not be exceeded by the UE during any period of time.

If the UE is configured with multiple TAGs and transmissions of the UE on subframe i for any serving cell in one TAG overlap some portion of the first symbol of the transmission on subframe i+1 for a different serving cell in another TAG, the UE minimum of $P_{\text{CMAX_L}}$ for subframes i and i+1 applies for any overlapping portion of subframes i and i+1. $P_{\text{PowerClass}}$ shall not be exceeded by the UE during any period of time.

In case PC2 and uplink intra-band contiguous CA capable UE receives p_{EMAX,c} in Scell then that applies both to Scell and Pcell once the Scell is activated.

The measured maximum output power P_{UMAX} over all serving cells shall be within the following range:

$$\begin{split} P_{CMAX_L} - MAX\{T_L,\,T_{LOW}(P_{CMAX_L})~\} & \leq ~P_{UMAX} \leq ~P_{CMAX_H} + ~T_{HIGH}(P_{CMAX_H}) \end{split}$$

$$P_{UMAX} = 10~log_{10} \sum p_{UMAX,c}$$

where $p_{UMAX,c}$ denotes the measured maximum output power for serving cell c expressed in linear scale. The tolerances $T_{LOW}(P_{CMAX})$ and $T_{HIGH}(P_{CMAX})$ for applicable values of P_{CMAX} are specified in Table 6.2.5A-1 and Table 6.2.5A-2 for inter-band carrier aggregation and intra-band carrier aggregation, respectively. The tolerance T_L is the absolute value of the lower tolerance for applicable E-UTRA CA configuration as specified in Table 6.2.2A-0, Table 6.2.2A-1 and Table 6.2.2A-2 for inter-band carrier aggregation, intra-band contiguous carrier aggregation and intra-band non-contiguous carrier aggregation, respectively.

Table 6.2.5A-1: P_{CMAX} tolerance for uplink inter-band CA (two bands)

P _{CMAX} (dBm)	Tolerance T _{LOW} (P _{CMAX}) (dB)	Tolerance T _{HIGH} (P _{CMAX}) (dB)
P _{CMAX} = 23	3.0	2.0
22 ≤ P _{CMAX} < 23	5.0	2.0
21 ≤ P _{CMAX} < 22	5.0	3.0
20 ≤ P _{CMAX} < 21	6.0	4.0
16 ≤ P _{CMAX} < 20	5	.0
11 ≤ P _{CMAc} < 16	6	.0
-40 ≤ P _{CMAX} < 11	7	.0

Table 6.2.5A-2: P_{CMAX} tolerance

P _{CMAX} (dBm)	Tolerance TLOW(PCMAX) (dB)	Tolerance Thigh(Pcmax) (dB)
21 ≤ P _{CMAX} ≤ 23	2	.0
20 ≤ P _{CMAX} < 21	2	.5
19 ≤ P _{CMAX} < 20	3	.5
18 ≤ P _{CMAX} < 19	4	.0
13 ≤ P _{CMAX} < 18	5	.0
8 ≤ P _{CMAX} < 13	6	.0
-40 ≤ P _{CMAX} < 8	7	.0

6.2.5B Configured transmitted power for UL-MIMO

For UE supporting UL-MIMO, the transmitted power is configured per each UE.

The definitions of configured maximum output power $P_{CMAX,c}$, the lower bound $P_{CMAX_L,c}$, and the higher bound $P_{CMAX_H,c}$ specified in subclause 6.2.5 shall apply to UE supporting UL-MIMO, where

- $P_{PowerClass}$ and $\Delta T_{C.c}$ are specified in subclause 6.2.2B;
- MPR, $_c$ is specified in subclause 6.2.3B;
- A-MPR $_{,c}$ is specified in subclause 6.2.4B.

The measured configured maximum output power $P_{UMAX,c}$ for serving cell c shall be within the following bounds:

$$P_{CMAX_L,c} - \ MAX\{T_L, T_{LOW}(P_{CMAX_L,c})\} \ \leq \ P_{UMAX,c} \leq \ P_{CMAX_H,c} + \ T_{HIGH}(P_{CMAX_H,c})$$

where $T_{LOW}(P_{CMAX_L,c})$ and $T_{HIGH}(P_{CMAX_H,c})$ are defined as the tolerance and applies to $P_{CMAX_L,c}$ and $P_{CMAX_H,c}$ separately, while T_L is the absolute value of the lower tolerance in Table 6.2.2B-1 for the applicable operating band.

For UE with two transmit antenna connectors in closed-loop spatial amultiplexing scheme, the tolerance is specified in Table 6.2.5B-1. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2.

PCMAX,c Tolerance Tolerance $T_{LOW}(P_{CMAX_L,c})$ (dB) THIGH(PCMAX_H,c) (dB) (dBm) $P_{CMAX,c} = 23$ 3.0 2.0 2.0 5.0 $22 \le P_{CMAX,c} < 23$ 5.0 3.0 $21 \le P_{CMAX,c} < 22$ $20 \le P_{CMAX,c} < 21$ 6.0 4.0 $16 \le P_{CMAX,c} < 20$ 5.0 11 ≤ P_{CMAX,c} < 16 6.0 $-40 \le P_{CMAX,c} < 11$ 7.0

Table 6.2.5B-1: P_{CMAX,c} tolerance in closed-loop spatial multiplexing scheme

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.2.5 apply.

6.2.5C Configured transmitted power for Dual Connectivity

For inter-band dual connectivity with one uplink serving cell per CG, the UE is allowed to set its configured maximum output power $P_{CMAX,c(i),i}$ for serving cell c(i) of CG i, i = 1,2, and its total configured maximum output power P_{CMAX} .

The configured maximum output power $P_{CMAX,c(i),i}(p)$ in subframe p of serving cell c(i) on CG i shall be set within the following bounds:

$$P_{\text{CMAX_L},c(i),i}(p) \leq P_{\text{CMAX},c(i),i}(p) \leq P_{\text{CMAX_H},c(i),i}(p)$$

where $P_{CMAX_L,c(i),i}(p)$ and $P_{CMAX_H,c(i),i}(p)$ are the limits for a serving cell c(i) of CG i as specified in subclause 6.2.5.

The total UE configured maximum output power $P_{CMAX}(p,q)$ in a subframe p of CG 1 and a subframe q of CG 2 that overlap in time shall be set within the following bounds for synchronous and asynchronous operation unless stated otherwise:

$$P_{\text{CMAX_L}}(p,q) \leq P_{\text{CMAX}}(p,q) \leq P_{\text{CMAX_H}}(p,q)$$

with

$$P_{\text{CMAX L}}(p,q) = \text{MIN} \{10 \log_{10} [p_{\text{CMAX L,c(1),1}}(p) + p_{\text{CMAX L,c(2),2}}(q)], P_{\text{PowerClass}} \}$$

$$P_{\text{CMAX_H}}(p,q) = \text{MIN} \{10 \log_{10} [p_{\text{CMAX_H},c(1),1}(p) + p_{\text{CMAX_H},c(2),2}(q)], P_{\text{PowerClass}} \}$$

where $p_{CMAX_L,c(i),i}$ is $p_{CMAX_H,c(i),i}$ are the respective limits $P_{CMAX_L,c(i),i}$ (p) and $P_{CMAX_H,c(i),i}$ (p) expressed in linear scale.

If the UE is configured in Dual Connectivity and synchronous transmissions of the UE on subframe p for a serving cell in one CG overlaps some portion of the first symbol of the transmission on subframe q+1 for a different serving cell in the other CG, the UE minimum of P_{CMAX_L} between subframes pairs (p, q) and (p+1, q+1) respectively applies for any overlapping portion of subframes (p, q) and (p+1, q+1). $P_{PowerClass}$ shall not be exceeded by the UE during any period of time.

The measured total maximum output power P_{UMAX} over both CGs is

$$P_{UMAX} = 10 \log_{10} [p_{UMAX,c(1),1} + p_{UMAX,c(2),2}],$$

where $p_{UMAX,c(i),i}$ denotes the measured output power of serving cell c(i) of CG i expressed in linear scale.

If the UE is configured in Dual Connectivity and synchronous transmissions

$$P_{CMAX_L}(p, q) - T_{LOW}(P_{CMAX_L}(p, q)) \le P_{UMAX} \le P_{CMAX_H}(p, q) + T_{HIGH}(P_{CMAX_H}(p, q))$$

where $P_{CMAX_L}(p,q)$ and $P_{CMAX_H}(p,q)$ are the limits for the pair (p,q) and with the tolerances $T_{LOW}(P_{CMAX})$ and $T_{HIGH}(P_{CMAX})$ for applicable values of P_{CMAX} specified in Table 6.2.5C-1. P_{CMAX_L} may be modified for any overlapping portion of subframes (p,q) and (p+1,q+1).

If the UE is configured in Dual Connectivity and asynchronous transmissions, the subframes of the leading CG are taken as reference subframes for the measurement of the total configured output power P_{UMAX} . If subframe p of CG 1 and subframe q of CG 2 overlap in time in their respective slot 0 and

- 1. if p leads in time over q, then p is the reference subframe and the (p,q) and (p,q-1) pairs are considered for determining the P_{CMAX} tolerance
- 2. if q leads in time over p, then q is the reference subframe and the (p-1,q) and (p,q) pairs are considered for determining the P_{CMAX} tolerance;

for the reference subframe p duration (when subframe p in CG 1 leads):

$$P'_{CMAX L} = MIN \{P_{CMAX L}(p,q), P_{CMAX L}(p,q-1)\}$$

$$P'_{CMAX H} = MAX \{P_{CMAX H} (p,q), P_{CMAX H} (p,q-1)\}$$

while for the reference subframe q duration (when subframe q in CG 2 leads):

$$P'_{CMAX_L} = MIN \{P_{CMAX_L} (p-1,q), P_{CMAX_L} (p,q)\}$$

$$P'_{CMAX_H} = MAX \{P_{CMAX_H} (p-1,q), P_{CMAX_H} (p,q)\}$$

where P_{CMAX_L} and P_{CMAX_H} are the applicable limits for each overlapping subframe pairs (p,q), (p,q-1) and (p-1,q). The measured total configured maximum output power P_{UMAX} shall be within the following bounds:

$$P'_{CMAX_L} - T_{LOW}(P'_{CMAX_L}) \le P_{UMAX} \le P'_{CMAX_H} + T_{HIGH}(P'_{CMAX_H})$$

with the tolerances T_{LOW}(P_{CMAX}) and T_{HIGH}(P_{CMAX}) for applicable values of P_{CMAX} specified in Table 6.2.5C-1.

Table 6.2.5C-1: P_{CMAX} tolerance for inter-band Dual Connectivity

P _{CMAX} (dBm)	Tolerance TLOW(PCMAX_L)(dB)	Tolerance Thigh (Pcmax_h)(dB)
P _{CMAX} = 23	3.0	2.0
22 ≤P _{CMAX} ,< 23	5.0	2.0
21 ≤ P _{CMAX} < 22	5.0	3.0
20 ≤ P _{CMAX} , < 21	6.0	4.0
16 ≤ P _{CMAX} < 20		5.0
11 ≤ P _{CMAX} , < 16	6.0	
-40 ≤ P _{CMAX} < 11	7.0	

6.2.5D Configured transmitted power for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the configured maximum output power $P_{CMAX,c}$ and power boundary requirement specified in subclause 6.2.5 shall apply to UE supporting ProSe, where

- MPR_c is specified in subclause 6.2.3D;
- A-MPR_c is specified in subclause 6.2.4D;
- $\Delta T_{ProSe} = 0.1 \text{ dB}.$

For $P_{\text{CMAX},PSSCH}$ and $P_{\text{CMAX},PSCCH}$, $P_{\text{EMAX},c}$ is the value given by IE P-Max for serving cell c, defined by [7], when present. $P_{\text{EMAX},c}$ is the value given by IE maxTxPower, defined by [7], when the UE is not associated with a serving cell on the ProSe carrier.

For $P_{\text{CMAX},PSDCH}$, $P_{\text{EMAX},c}$ is the value given by the IE discMaxTxPower in [7].

For $P_{\text{CMAX},PSBCH}$, $P_{\text{EMAX},c}$ is the value given by the IE maxTxPower in [7] when the ProSe UE is not associated with a serving cell on the ProSe carrier. When the UE is associated with a serving cell, then $P_{\text{EMAX},c}$ is the value given by the IE P-Max when PSBCH/SLSS transmissions is triggered for ProSe Direct communication as specified in [7], and is the value given by the IE discMaxTxPower in [7] otherwise.

For $P_{\text{CMAX},SSSS}$, the value is as calculated for $P_{\text{CMAX},PSBCH}$ and applying the MPR for SSSS as specified in Section 6.2.3D.

When a UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the UE is allowed to set its configured maximum output power $P_{CMAX,c,E-UTRA}$ and $P_{CMAX,c,ProSe}$ for the configured E-UTRA uplink carrier and the configured E-UTRA ProSe carrier, respectively, and its total configured maximum output power $P_{CMAX,c}$.

The configured maximum output power $P_{CMAX\ c,E-UTRA}(p)$ in subframe p for the configured E-UTRA uplink carrier shall be set within the bounds:

$$P_{\text{CMAX L.c.E-UTRA}}(p) \leq P_{\text{CMAX.c.E-UTRA}}(p) \leq P_{\text{CMAX H.c.E-UTRA}}(p)$$

where P_{CMAX_L,c,E-UTRA} and P_{CMAX_H,c,E-UTRA} are the limits for a serving cell c as specified in subclause 6.2.5.

The configured maximum output power $P_{CMAX\ c,ProSe}(q)$ in subframe q for the configured E-UTRA ProSe carrier shall be set within the bounds:

$$P_{CMAX,c,ProSe}(q) \leq P_{CMAX_H,c,ProSe}(q)$$

where P_{CMAX_H,c,ProSe} is the limit as specified in subclause 6.2.5D.

The total UE configured maximum output power $P_{CMAX}(p,q)$ in a subframe p of an E-UTRA uplink carrier and a subframe q of an E-UTRA ProSe sidelink that overlap in time shall be set within the following bounds for synchronous and asynchronous operation unless stated otherwise:

$$P_{CMAX L}(p,q) \le P_{CMAX}(p,q) \le P_{CMAX H}(p,q)$$

with

$$P_{CMAX L}(p,q) = P_{CMAX L,c,E-UTRA}(p)$$

$$P_{\text{CMAX_H}}(p,q) = \text{MIN} \left\{ 10 \log_{10} \left[p_{\text{CMAX_H,c,E-UTRA}}(p) + p_{\text{CMAX_H,c,ProSe}}(q) \right], P_{\text{PowerClass}} \right\}$$

where $p_{CMAX_H,c,ProSe}$ and $p_{CMAX_H,c,E-UTRA}$ are the limits $P_{CMAX_H,c,ProSe}(q)$ and $P_{CMAX_H,c,E-UTRA}(p)$ expressed in linear scale.

The measured total maximum output power P_{UMAX} over both the E-UTRA uplink and E-UTRA ProSe carriers is

$$P_{UMAX} = 10 \log_{10} \left[p_{UMAX,c,E-UTRA} + p_{UMAX,c,ProSe} \right],$$

where $p_{UMAX,c,E-UTRA}$ denotes the measured output power of serving cell c for the configured E-UTRA uplink carrier, and $p_{UMAX,c,ProSe}$ denotes the measured output power for the configured E-UTRA ProSe carrier expressed in linear scale.

When a UE is configured for synchronous ProSe and uplink transmissions,

$$\mathsf{P}_{\mathsf{CMAX_L}}(p,\,q) \ - \ \mathsf{T}_{\mathsf{LOW}}\left(\mathsf{P}_{\mathsf{CMAX_L}}(p,\,q)\right) \ \leq \ \mathsf{P}_{\mathsf{UMAX}} \ \leq \ \mathsf{P}_{\mathsf{CMAX_H}}(p,\,q) \ + \ \mathsf{T}_{\mathsf{HIGH}}\left(\mathsf{P}_{\mathsf{CMAX_H}}(p,\,q)\right)$$

where $P_{CMAX_L}(p,q)$ and $P_{CMAX_H}(p,q)$ are the limits for the pair (p,q) and with the tolerances $T_{LOW}(P_{CMAX})$ and $T_{HIGH}(P_{CMAX})$ for applicable values of P_{CMAX} specified in Table 6.2.5C-1. P_{CMAX_L} may be modified for any overlapping portion of subframes (p,q) and (p+1,q+1).

When a UE is configured for asynchronous ProSe and uplink transmissions, the carrier configured for uplink transmission is taken as the reference. If subframe p for the E-UTRA uplink carrier and subframe q for the E-UTRA ProSe carrier overlap in time and

- 1. if uplink carrier leads in time over q, then p is the reference subframe and, the (p,q) and (p,q-1) pairs are considered for determining the P_{CMAX} tolerance
- 2. if ProSe carrier leads in time over p, then p is the reference subframe and, the (p,q) and (p,q+1) pairs are considered for determining the P_{CMAX} tolerance

For the reference subframe p duration when uplink carrier leads:

$$P'_{CMAX_L} = P_{CMAX_L,,cE-UTRA}(p)$$

$$P'_{CMAX_H} = MAX \{P_{CMAX_H} (p,q-1), P_{CMAX_H} (p,q)\}$$

For the reference subframe *p* duration when ProSe carrier leads:

$$P'_{CMAX L} = P_{CMAX L,cE-UTRA}(p)$$

$$P'_{CMAX H} = MAX \{P_{CMAX H} (p,q), P_{CMAX H} (p,q+1)\}$$

where $P_{CMAX_L,cE-UTRA}(p)$ and P_{CMAX_H} are the applicable limits for each overlapping subframe pairs (p,q), (p,q+1), (p,q-1). The measured total configured maximum output power P_{UMAX} shall be within the following bounds:

$$P'_{CMAX_L} \ - \ T_{LOW} \left(P'_{CMAX_L} \right) \ \leq \ P_{UMAX} \ \leq \ P'_{CMAX_H} + T_{HIGH} \left(P'_{CMAX_H} \right)$$

with the tolerances $T_{LOW}(P_{CMAX})$ and $T_{HIGH}(P_{CMAX})$ for applicable values of P_{CMAX} specified in Table 6.2.5C-1.

6.2.5F Configured transmitted Power for category NB1

For each slot i the category NB1 UE is allowed to set its configured maximum output power $P_{CMAX,c}$. The configured maximum output power $P_{CMAX,c}$ is set within the following bounds:

$$P_{CMAX L,c} \le P_{CMAX,c} \le P_{CMAX H,c}$$

Where

- $P_{CMAX_L,c} = MIN \{ P_{EMAX,c}, P_{PowerClass} MPR_c A-MPR_c \}$
- $P_{CMAX_H,c} = MIN \{ P_{EMAX,c}, P_{PowerClass} \}$
- P_{EMAX,c} is the value given to IE *P-Max*, defined in [7]
- P_{PowerClass} is the maximum category NB1 UE power specified in Table 6.2.2F-1 without taking into account the associated tolerance
- MPR_c is specified in subclause 6.2.3F
- A-MPR $_c$ = 0dB unless otherwise stated.

The measurement period for $P_{UMAX,c}$ is at least one sub-frame (1ms) for 15 KHz channel spacing, and at least a 2ms slot (excluding the 2304Ts gap when UE is not transmitting) respectively for the 3.75 KHz channel spacing. The measured maximum output power $P_{UMAX,c}$ shall be within the following bounds:

$$P_{CMAX_L,c} - T(P_{CMAX_L,c}) \leq P_{UMAX,c} \leq P_{CMAX_H,c} + T(P_{CMAX_H,c})$$

Where $T(P_{CMAX})$ is defined by the tolerance table below and applies to $P_{CMAX_L,c}$ and $P_{CMAX_L,c}$ separately.

Table 6.2.5F-1: P_{CMAX} tolerance for power class 3

P _{CMAX} (dBm)	Tolerance T(P _{CMAX}) (dB)
21 ≤ P _{CMAX} ≤ 23	2.0
20 ≤ P _{CMAX} < 21	2.5
19 ≤ P _{CMAX} < 20	3.5
18 ≤ P _{CMAX} < 19	4.0
13 ≤ P _{CMAX} < 18	5.0
8 ≤ P _{CMAX} < 13	6.0
-40 ≤ P _{CMAX} < 8	7.0

 $P_{CMAX,c}$ Tolerance T(P_{CMAX,c}) (dBm) (dB) 18 ≤ P_{CMAX} ≤ 20 2.0 2.5 $17 \le P_{\text{CMAX},c} < 18$ $16 \le P_{CMAX,c} < 17$ 3.5 $15 \le P_{CMAX,c} < 16$ 4.0 $10 \le P_{CMAX,c} < 15$ 5.0 $5 \le P_{CMAX,c} < 10$ 6.0 $-40 \le P_{CMAX,c} < 5$ 7.0

Table 6.2.5F-2: P_{CMAX} tolerance for power class 5

6.3 Output power dynamics

6.3.1 (Void)

6.3.2 Minimum output power

The minimum controlled output power of the UE is defined as the broadband transmit power of the UE, i.e. the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks), when the power is set to a minimum value.

6.3.2.1 Minimum requirement

The minimum output power is defined as the mean power in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2.1-1.

Channel bandwidth / Minimum output power / Measurement bandwidth 1.4 3.0 10 15 20 MHz MHz MHz MHz MHz MHz Minimum output -40 dBm power Measurement 1.08 MHz 2.7 MHz 4.5 MHz 9.0 MHz 13.5 MHz 18 MHz bandwidth

Table 6.3.2.1-1: Minimum output power

6.3.2A UE Minimum output power for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands and intra-band contiguous and non-contiguous carrier aggregation, the minimum controlled output power of the UE is defined as the transmit power of the UE per component carrier, i.e., the power in the channel bandwidth of each component carrier for all transmit bandwidth configurations (resource blocks), when the power on both component carriers are set to a minimum value.

6.3.2A.1 Minimum requirement for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the minimum output power is defined per carrier and the requirement is specified in subclause 6.3.2.1. If two contiguous component carriers are assigned to one E-UTRA band, the requirements in subclause 6.3.2A.1 apply for those component carriers.

For intra-band contiguous and non-contiguous carrier aggregation the minimum output power is defined as the mean power in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2A.1-1.

Table 6.3.2A.1-1: Minimum output power for intra-band contiguous and non-contiguous CA UE

	CC Channel bandwidth / Minimum output power / Measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power			-40 c	dBm		
Measurement bandwidth			4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

6.3.2B UE Minimum output power for UL-MIMO

For UE supporting UL-MIMO, the minimum controlled output power is defined as the broadband transmit power of the UE, i.e. the sum of the power in the channel bandwidth for all transmit bandwidth configurations (resource blocks) at each transmit antenna connector, when the UE power is set to a minimum value.

6.3.2B.1 Minimum requirement

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the minimum output power is defined as the sum of the mean power at each transmit connector in one sub-frame (1ms). The minimum output power shall not exceed the values specified in Table 6.3.2B.1-1.

Table 6.3.2B.1-1: Minimum output power

	Channel bandwidth / Minimum output power / Measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Minimum output power	-40 dBm					
Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.3.2 apply.

6.3.2C Void

<reserved for future use>

6.3.2D UE Minimum output power for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the requirements in subclause 6.3.2 apply for ProSe transmission.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.3.2A apply as specified for the corresponding inter-band aggregation with uplink assigned to two bands.

6.3.2F UE Minimum output power for category NB1

For category NB1 UE the single-tone and multi-tone transmission minimum output power requirement for the channel bandwidth is -40 dBm. For 3.75kHz sub-carrier spacing the minimum output power is defined as mean power in one slot (2ms) excluding the 2304Ts gap when UE is not transmitting. For 15kHz sub-carrier spacing the minimum output power is defined as mean power in one sub-frame (1ms).

6.3.3 Transmit OFF power

Transmit OFF power is defined as the mean power when the transmitter is OFF. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During DTX and measurements gaps, the UE is not considered to be OFF.

6.3.3.1. Minimum requirement

The transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 6.3.3.1-1.

Channel bandwidth / Transmit OFF power / Measurement bandwidth 10 1 4 3.0 15 20 MHz MHz MHz MHz MHz MHz Transmit OFF -50 dBm power Measurement 1.08 MHz 2.7 MHz 4.5 MHz 9.0 MHz 13.5 MHz 18 MHz bandwidth

Table 6.3.3.1-1: Transmit OFF power

6.3.3A UE Transmit OFF power for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands and intra-band contiguous and non-contiguous carrier aggregation, transmit OFF power is defined as the mean power per component carrier when the transmitter is OFF on all component carriers. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During measurements gaps, the UE is not considered to be OFF.

6.3.3A.1 Minimum requirement for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, transmit OFF power requirement is defined per carrier and the requirement is specified in subclause 6.3.3.1. If two contiguous component carriers are assigned to one E-UTRA band, the requirements in subclause 6.3.3A.1 apply for those component carriers.

For intra-band contiguous and non-contiguous carrier aggregation the transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power shall not exceed the values specified in Table 6.3.3A.1-1.

Table 6.3.3A.1-1: Transmit OFF power for intra-band contiguous and non-contiguos CA UE

	CC Channel bandwidth / Transmit OFF power / Measurement bandwidth					
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Transmit OFF power			-50 c	lBm		
Measurement bandwidth			4.5 MHz	9.0 MHz	13.5 MHz	18 MHz

6.3.3B UE Transmit OFF power for UL-MIMO

For UE supporting UL-MIMO, the transmit OFF power is defined as the mean power at each transmit antenna connector when the transmitter is OFF at all transmit antenna connectors. The transmitter is considered to be OFF when the UE is not allowed to transmit or during periods when the UE is not transmitting a sub-frame. During DTX and measurements gaps, the UE is not considered to be OFF.

6.3.3B.1 Minimum requirement

The transmit OFF power is defined as the mean power at each transmit antenna connector in a duration of at least one sub-frame (1ms) excluding any transient periods. The transmit OFF power at each transmit antenna connector shall not exceed the values specified in Table 6.3.3B.1-1.

Channel bandwidth / Transmit OFF power/ Measurement bandwidth 20 1.4 3.0 5 10 15 MHz MHz MHz MHz MHz MHz Transmit OFF -50 dBm power Measurement 13.5 MHz 1.08 MHz 2.7 MHz 4.5 MHz 9.0 MHz 18 MHz bandwidth

Table 6.3.3B.1-1: Transmit OFF power per antenna port

6.3.3D Transmit OFF power for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the Prose UE shall meet the Transmit OFF power at all times when the UE is not associated with a serving cell on the ProSe carrier and does not have knowledge of its geographical area or is provisioned with pre-configured radio parameters that are not associated with any known Geographical Area.

The requirements specified in subclause 6.3.3 shall apply to UE supporting ProSe when

- the UE is associated with a serving cell on the ProSe carrier, or
- the UE is not associated with a serving cell on the ProSe carrier and is provisioned with the preconfigured radio parameters for ProSe Direct Communications and/or ProSe Direct Discovery that are associated with known Geographical Area, or
- the UE is associated with a serving cell on a carrier different than the ProSe carrier, and the radio parameters for ProSe Direct Discovery on the ProSe carrier are provided by the serving cell, or
- the UE is associated with a serving cell on a carrier different than the ProSe carrier, and has a non-serving cell selected on the ProSe carrier that supports ProSe Direct Discovery and/or ProSe Direct Communication.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, transmit OFF power is defined as the mean power per component carrier when the transmitter is OFF on all component carriers. During measurement gaps and transmission/reception gaps for ProSe, the UE is not considered to be OFF. Transmit OFF power requirement as specified in subclause 6.3.3 apply per carrier.

6.3.3F Transmit OFF power for category NB1

For category NB1 UE the transmit OFF power requirement for the channel bandwidth is -50 dBm. For 3.75kHz sub-carrier spacing the transmit OFF power is defined as mean power in one slot (2ms) excluding the 2304Ts gap when UE is not transmitting. For 15kHz sub-carrier spacing the transmit OFF power is defined as mean power in one sub-frame (1ms).

6.3.4 ON/OFF time mask

6.3.4.1 General ON/OFF time mask

The General ON/OFF time mask defines the observation period between Transmit OFF and ON power and between Transmit ON and OFF power. ON/OFF scenarios include; the beginning or end of DTX, measurement gap, contiguous, and non contiguous transmission

The OFF power measurement period is defined in a duration of at least one sub-frame excluding any transient periods. The ON power is defined as the mean power over one sub-frame excluding any transient period.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

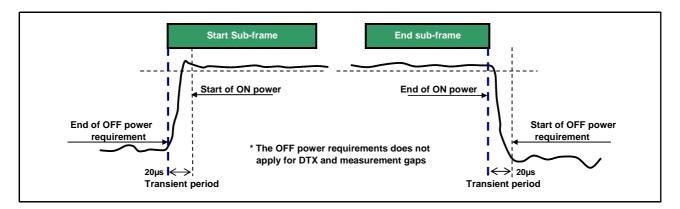


Figure 6.3.4.1-1: General ON/OFF time mask

6.3.4.2 PRACH and SRS time mask

6.3.4.2.1 PRACH time mask

The PRACH ON power is specified as the mean power over the PRACH measurement period excluding any transient periods as shown in Figure 6.3.4.2-1. The measurement period for different PRACH preamble format is specified in Table 6.3.4.2-1.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

PRACH preamble format	Measurement period (ms)		
0	0.9031		
1	1.4844		
2	1.8031		
3	2.2844		
4	0.1479		

Table 6.3.4.2-1: PRACH ON power measurement period

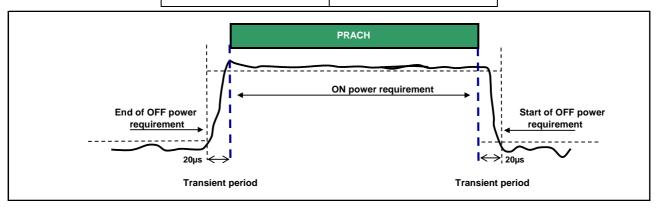


Figure 6.3.4.2-1: PRACH ON/OFF time mask

6.3.4.2.2 SRS time mask

In the case a single SRS transmission, the ON power is defined as the mean power over the symbol duration excluding any transient period. Figure 6.3.4.2.2-1

In the case a dual SRS transmission, the ON power is defined as the mean power for each symbol duration excluding any transient period. Figure 6.3.4.2.2-2

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

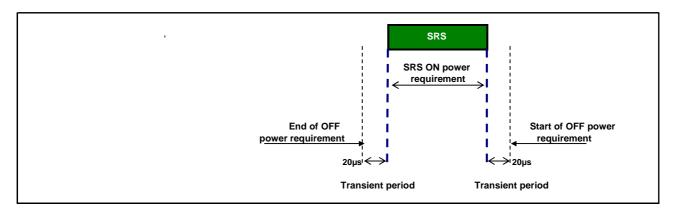


Figure 6.3.4.2.2-1: Single SRS time mask

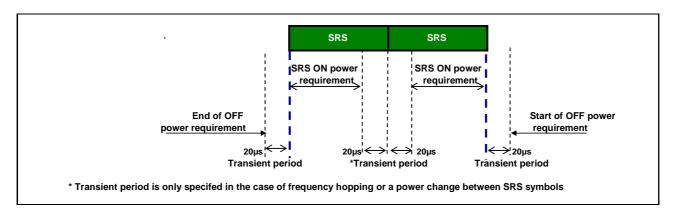


Figure 6.3.4.2.2-2: Dual SRS time mask for the case of UpPTS transmissions

6.3.4.3 Slot / Sub frame boundary time mask

The sub frame boundary time mask defines the observation period between the previous/subsequent sub–frame and the (reference) sub-frame. A transient period at a slot boundary within a sub-frame is only allowed in the case of Intra-sub frame frequency hopping. For the cases when the subframe contains SRS the time masks in subclause 6.3.4.4 apply.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

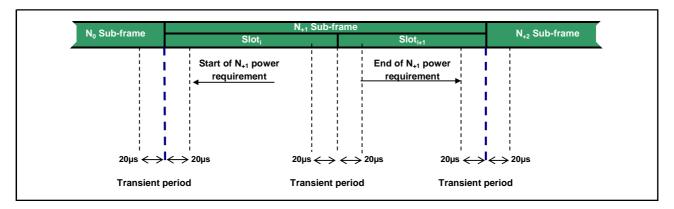


Figure 6.3.4.3-1: Transmission power template

6.3.4.4 PUCCH / PUSCH / SRS time mask

The PUCCH/PUSCH/SRS time mask defines the observation period between sounding reference symbol (SRS) and an adjacent PUSCH/PUCCH symbol and subsequent sub-frame.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3

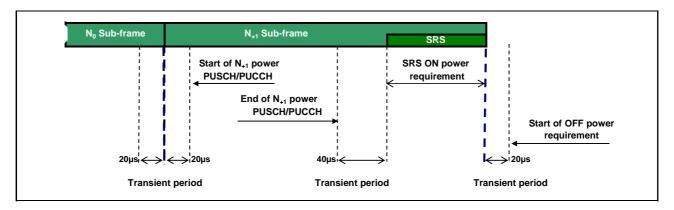


Figure 6.3.4.4-1: PUCCH/PUSCH/SRS time mask when there is a transmission before SRS but not after

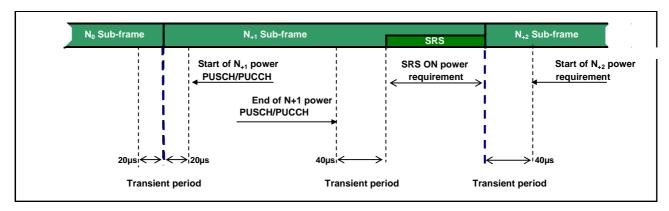


Figure 6.3.4.4-2: PUCCH/PUSCH/SRS time mask when there is transmission before and after SRS

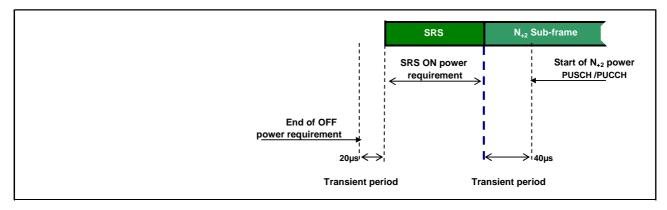


Figure 6.3.4.4-3: PUCCH/PUSCH/SRS time mask when there is a transmission after SRS but not before

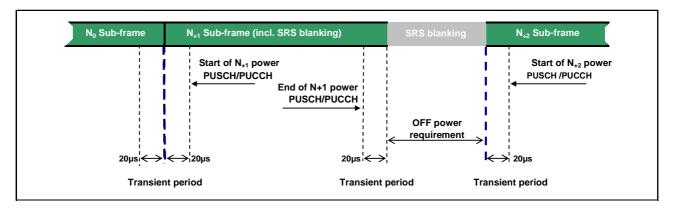


Figure 6.3.4.4-4: SRS time mask when there is FDD SRS blanking

6.3.4A ON/OFF time mask for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands and intra-band contiguous and non-contiguous carrier aggregation, the general output power ON/OFF time mask specified in subclause 6.3.4.1 is applicable for each component carrier during the ON power period and the transient periods. The OFF period as specified in subclause 6.3.4.1 shall only be applicable for each component carrier when all the component carriers are OFF.

6.3.4B ON/OFF time mask for UL-MIMO

For UE supporting UL-MIMO, the ON/OFF time mask requirements in subclause 6.3.4 apply at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the general ON/OFF time mask requirements specified in subclause 6.3.4.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.3.4 apply.

6.3.4D ON/OFF time mask for ProSe

For ProSe Direct Discovery and ProSe Direct Communications, additional requirements on ON/OFF time masks for ProSe physical channels and signals are specified in this clause.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.3.4D apply for ProSe transmission and the requirements in subclause 6.3.4 apply for uplink transmission.

6.3.4D.1 General time mask for ProSe

The General ON/OFF time mask defines the observation period between the Transmit OFF and ON power and between Transmit ON and OFF power for PSDCH, PSCCH, and PSSCH transmissions in a subframe wherein the last symbol is punctured to create a guard period.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3.

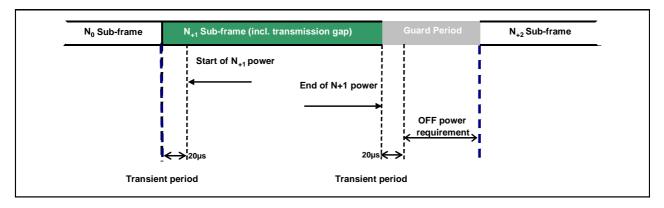


Figure 6.3.4D.1-1: PSDCH/PSCCH/PSSCH time mask

6.3.4D.2 PSSS/SSS time mask

The PSSS time mask / SSSS time mask defines the observation period between the Transmit OFF and ON power and between Transmit ON and OFF power for PSSS/SSSS transmissions in a subframe when not multiplexed with PSBCH in that subframe.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3.

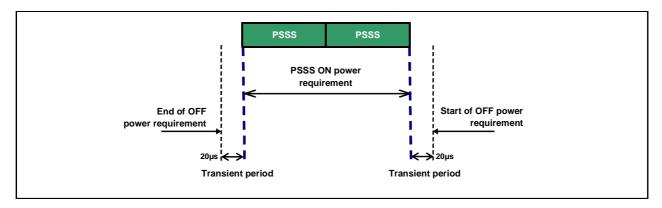


Figure 6.3.4D.2-1: PSSS time mask for normal CP transmission (when not time-multiplexed with PSBCH)

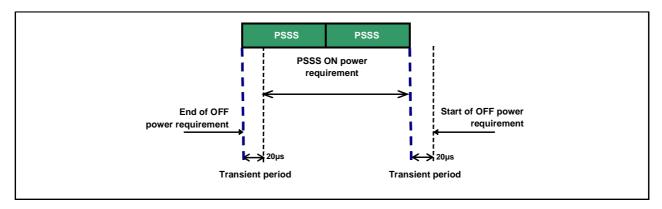


Figure 6.3.4D.2-2: PSSS time mask for extended CP transmission (when not time-multiplexed with PSBCH)

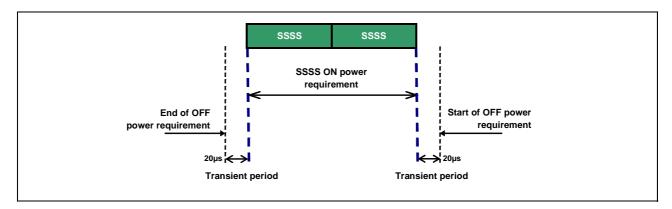


Figure 6.3.4D.2-3: SSSS time mask (when not time-multiplexed with PSBCH)

6.3.4D.3 PSSS / SSSS / PSBCH time mask

The PSSS/SSSS/PSBCH time mask defines the observation period between SSSS and adjacent PSSS/PSBCH symbols in a subframe, with last symbol punctured to create a guard period.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3.

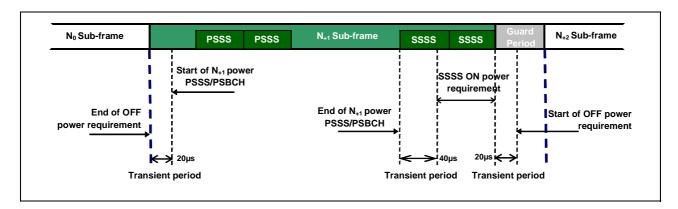


Figure 6.3.4D.3-1: PSSS/SSSS/PBCH time mask for normal CP transmission

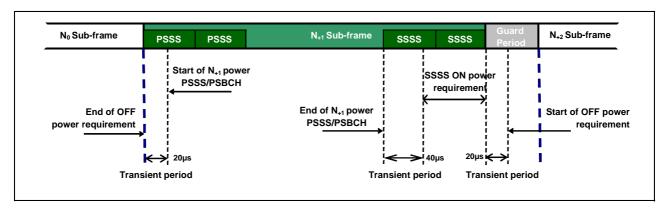


Figure 6.3.4D.3-2: PSSS/SSSS/PBCH time mask for extended CP transmission

6.3.4D.4 PSSCH / SRS time mask

The PSSCH/SRS time mask defines the observation period between sounding reference symbol (SRS) and an adjacent PSSCH symbol and subsequent sub-frame.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2 and subclause 6.6.2.3.

The PSSCH/SRS time mask shall follow the PUSCH/PUCCH/SRS time mask as specified in subclause 6.3.4.4.

6.3.4F ON/OFF time mask for category NB1

6.3.4F.1 General ON/OFF time mask

E-UTRA general ON/OFF time mask in subclause 6.3.4.1 applies for category NB1 UE with an exception that for 3.75kHz sub-carrier spacing the transmit OFF power is defined as mean power in one slot (2ms) and for 15kHz subcarrier spacing the transmit OFF power is defined as mean power in one sub-frame (1ms), excluding any transient periods. The ON power is defined as the mean power over one RU excluding any transient periods.

6.3.4F.2 NPRACH time mask

The NPRACH ON power is specified as the mean power over the NPRACH measurement period excluding any transient periods as shown in Figure 6.3.4F.2-1. The measurement period for different NPRACH preamble format is specified in Table 6.3.4F.2-1.

There are no additional requirements on UE transmit power beyond that which is required in subclause 6.2.2F and subclause 6.6.2.3F.

Table 6.3.4F.2-1: NPRACH ON power measurement period

NPRACH preamble format	Measurement period (ms)
0	5.6
1	6.4

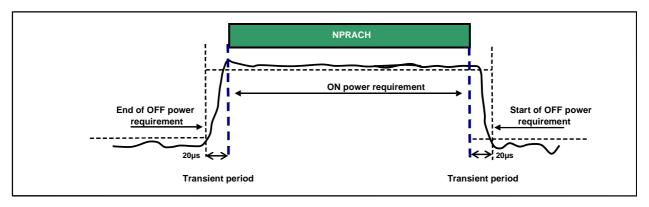


Figure 6.3.4F.2-1: NPRACH ON/OFF time mask

6.3.5 Power Control

6.3.5.1 Absolute power tolerance

Absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap larger than 20ms. This tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133)

In the case of a PRACH transmission, the absolute tolerance is specified for the first preamble. The absolute power tolerance includes the channel estimation error (the absolute RSRP accuracy requirement specified in subclause 9.1 of TS 36.133).

6.3.5.1.1 Minimum requirements

The minimum requirement for absolute power tolerance is given in Table 6.3.5.1.1-1 over the power range bounded by the Maximum output power as defined in subclause 6.2.2 and the Minimum output power as defined in subclause 6.3.2.

For operating bands under NOTE 2 in Table 6.2.2-1, the absolute power tolerance as specified in Table 6.3.5.1.1-1 is relaxed by reducing the lower limit by 1.5 dB when the transmission bandwidth is confined within F_{UL_low} and F_{UL_high} + 4 MHz or F_{UL_high} - 4 MHz and F_{UL_high} .

Table 6.3.5.1.1-1: Absolute power tolerance

Conditions	Tolerance
Normal	± 9.0 dB
Extreme	± 12.0 dB

6.3.5.2 Relative Power tolerance

The relative power tolerance is the ability of the UE transmitter to set its output power in a target sub-frame relatively to the power of the most recently transmitted reference sub-frame if the transmission gap between these sub-frames is ≤ 20 ms.

For PRACH transmission, the relative tolerance is the ability of the UE transmitter to set its output power relatively to the power of the most recently transmitted preamble. The measurement period for the PRACH preamble is specified in Table 6.3.4.2-1.

6.3.5.2.1 Minimum requirements

The requirements specified in Table 6.3.5.2.1-1 apply when the power of the target and reference sub-frames are within the power range bounded by the Minimum output power as defined in subclause 6.3.2 and the measured PUMAX as

defined in subclause 6.2.5 (i.e, the actual power as would be measured assuming no measurement error). This power shall be within the power limits specified in subclause 6.2.5.

To account for RF Power amplifier mode changes 2 exceptions are allowed for each of two test patterns. The test patterns are a monotonically increasing power sweep and a monotonically decreasing power sweep over a range bounded by the requirements of minimum power and maximum power specified in subclauses 6.3.2 and 6.2.2. For these exceptions the power tolerance limit is a maximum of ± 6.0 dB in Table 6.3.5.2.1-1

Table 6.3.5.2.1-1 Relative power tolerance for transmission (normal conditions)

Power step ΔP (Up or down) [dB]	All combinations of PUSCH and PUCCH transitions [dB]	All combinations of PUSCH/PUCCH and SRS transitions between sub- frames [dB]	PRACH [dB]
ΔP < 2	±2.5 (NOTE 3)	±3.0	±2.5
2 ≤ ΔP < 3	±3.0	±4.0	±3.0
3 ≤ ΔP < 4	±3.5	±5.0	±3.5
4 ≤ ΔP ≤ 10	±4.0	±6.0	±4.0
10 ≤ ΔP < 15	±5.0	±8.0	±5.0
15 ≤ ΔP	±6.0	±9.0	±6.0

NOTE 1: For extreme conditions an additional ± 2.0 dB relaxation is allowed NOTE 2: For operating bands under NOTE 2 in Table 6.2.2-1, the relative power tolerance is relaxed by increasing the upper limit by 1.5 dB if the transmission bandwidth of the reference sub-frames is confined within Fullow and Fullow + 4 MHz or Fullhigh – 4 MHz and Fullhigh and the target sub-frame is not confined within any one of these frequency ranges; if the transmission bandwidth of the target sub-frame is confined within Fullow and Fullow + 4 MHz or Fullhigh – 4 MHz and Fullhigh and the reference sub-frame is not confined within any one of these frequency ranges, then the tolerance is relaxed by reducing the lower limit by 1.5 dB.

NOTE 3: For PUSCH to PUSCH transitions with the allocated resource blocks fixed in frequency and no transmission gaps other than those generated by downlink subframes, DwPTS fields or Guard Periods for TDD: for a power step $\Delta P \le 1$ dB, the relative power tolerance for transmission is ± 1.0 dB.

The power step (ΔP) is defined as the difference in the calculated setting of the UE Transmit power between the target and reference sub-frames with the power setting according to subclause 5.1 of [TS 36.213]. The error is the difference between ΔP and the power change measured at the UE antenna port with the power of the cell-specific reference signals kept constant. The error shall be less than the relative power tolerance specified in Table 6.3.5.2.1-1.

For sub-frames not containing an SRS symbol, the power change is defined as the relative power difference between the mean power of the original reference sub-frame and the mean power of the target subframe not including transient durations. The mean power of successive sub-frames shall be calculated according to Figure 6.3.4.3-1 and Figure 6.3.4.1-1 if there is a transmission gap between the reference and target sub-frames.

If at least one of the sub-frames contains an SRS symbol, the power change is defined as the relative power difference between the mean power of the last transmission within the reference sub-frame and the mean power of the first transmission within the target sub-frame not including transient durations. A transmission is defined as PUSCH, PUCCH or an SRS symbol. The mean power of the reference and target sub-frames shall be calculated according to Figures 6.3.4.1-1, 6.3.4.2-1, 6.3.4.4-1, 6.3.4.4-2 and 6.3.4.4-3 for these cases.

6.3.5.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in TS 36.213 are constant. For HD-FDD UEs that support coverage enhancement (CE), the requirements on aggregate power control tolerance in 6.3.5E.3 apply.

6.3.5.3.1 Minimum requirement

The UE shall meet the requirements specified in Table 6.3.5.3.1-1 for aggregate power control over the power range bounded by the minimum output power as defined in subclause 6.3.2 and the maximum output power as defined in subclause 6.2.2.

Table 6.3.5.3.1-1: Aggregate power control tolerance

TPC command	UL channel	Aggregate power tolerance within 21 ms
0 dB	PUCCH	±2.5 dB
0 dB PUSCH		±3.5 dB
NOTE: The UE transmission gap is 4 ms. TPC command is transmitted via PDCCH 4 subframes preceding each PUCCH/PUSCH transmission.		

6.3.5A Power control for CA

The requirements apply for one single PUCCH, PUSCH or SRS transmission of contiguous PRB allocation per component carrier with power setting in accordance with Clause 5.1 of [6].

6.3.5A.1 Absolute power tolerance

The absolute power tolerance is the ability of the UE transmitter to set its initial output power to a specific value for the first sub-frame at the start of a contiguous transmission or non-contiguous transmission with a transmission gap on each active component carriers larger than 20ms. The requirement can be tested by time aligning any transmission gaps on the component carriers.

6.3.5A.1.1 Minimum requirements

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the absolute power control tolerance is specified on each component carrier exceed the minimum output power as defined in subclause 6.3.2A and the total power is limited by maximum output power as defined in subclause 6.2.2A. The requirements defined in Table 6.3.5.1.1-1 shall apply on each component carrier with all component carriers active. The requirements can be tested by time aligning any transmission gaps on all the component carriers.

For intra-band contiguous carrier aggregation bandwidth class B and C and intra-band non-contiguous carrier aggregation the absolute power control tolerance per component carrier is given in Table 6.3.5.1.1-1.

6.3.5A.2 Relative power tolerance

6.3.5A.2.1 Minimum requirements

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the relative power tolerance is specified when the power of the target and reference sub-frames on each component carrier exceed the minimum output power as defined in subclause 6.3.2A and the total power is limited by P_{UMAX} as defined in subclause 6.2.5A. The requirements shall apply on each component carrier with all component carriers active. The UE transmitter shall have the capability of changing the output power independently on all component carriers in the uplink and:

- a) the requirements for all combinations of PUSCH and PUCCH transitions per component carrier is given in Table 6.3.5.2.1-1.
- b) for SRS the requirements for combinations of PUSCH/PUCCH and SRS transitions between subframes given in Table 6.3.5.2.1-1 apply per component carrier when the target and reference subframes are configured for either simultaneous SRS or simultaneous PUSCH.
- c) for RACH the requirements apply for the primary cell and are given in Table 6.3.5.2.1-1.

For intra-band contiguous carrier aggregation bandwidth class B and C and intra-band non-contiguous carrier aggregation, the requirements apply when the power of the target and reference sub-frames on each component carrier

exceed -20 dBm and the total power is limited by P_{UMAX} as defined in subclause 6.2.5A. For the purpose of these requirements, the power in each component carrier is specified over only the transmitted resource blocks.

The UE shall meet the following requirements for transmission on both assigned component carriers when the average transmit power per PRB is aligned across both assigned carriers in the reference sub-frame:

- a) for all possible combinations of PUSCH and PUCCH transitions per component carrier, the corresponding requirements given in Table 6.3.5.2.1-1;
- b) for SRS transitions on each component carrier, the requirements for combinations of PUSCH/PUCCH and SRS transitions given in Table 6.3.5.2.1-1 with simultaneous SRS of constant SRS bandwidth allocated in the target and reference subrames;
- c) for RACH on the primary component carrier, the requirements given in Table 6.3.5.2.1-1 for PRACH.

For a) and b) above, the power step ΔP between the reference and target subframes shall be set by a TPC command and/or an uplink scheduling grant transmitted by means of an appropriate DCI Format.

For a), b) and c) above, two exceptions are allowed for each component carrier for a power per carrier ranging from -20 dBm to $P_{UMAX,c}$ as defined in subclause 6.2.5. For these exceptions the power tolerance limit is ± 6.0 dB in Table 6.3.5.2.1-1.

6.3.5A.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission within 21 ms in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in [6] are constant on all active component carriers.

6.3.5A.3.1 Minimum requirements

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the aggregate power tolerance is specified on each component carrier exceed the minimum output power as defined in subclause 6.3.2A and the total power is limited by maximum output power as defined in subclause 6.2.2A. The requirements defined in Table 6.3.5.3.1-1 shall apply on each component carrier with all component carriers active. The requirements can be tested by time aligning any transmission gaps on both the component carriers.

For intra-band contiguous carrier aggregation bandwidth class B and C and intra-band non-contiguous carrier aggregation, the aggregate power tolerance per component carrier is given in Table 6.3.5.3.1-1 with either simultaneous PUSCH or simultaneous PUCCH-PUSCH (if supported by the UE) configured. The average power per PRB shall be aligned across both assigned carriers before the start of the test. The requirement can be tested with the transmission gaps time aligned between component carriers.

6.3.5B Power control for UL-MIMO

For UE supporting UL-MIMO, the power control tolerance applies to the sum of output power at each transmit antenna connector.

The power control requirements specified in subclause 6.3.5 apply to UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme. The requirements shall be met with UL-MIMO configurations specified in Table 6.2.2B-2, wherein

- The Maximum output power requirements for UL-MIMO are specified in subclause 6.2.2B
- The Minimum output power requirements for UL-MIMO are specified in subclause 6.3.2B
- The requirements for configured transmitted power for UL-MIMO are specified in subclause 6.2.5B.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.3.5 apply.

6.3.5D Power Control for ProSe

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.3.5D apply for ProSe transmission and the requirements in subclause 6.3.5 apply for uplink transmission.

6.3.5D.1 Absolute power tolerance

For ProSe transmissions, the absolute power tolerance requirements specified in subclause 6.3.5.1 shall apply for each ProSe transmission.

6.3.5E Power control for category M1

6.3.5E.1 Absolute power tolerance

The absolute power tolerance requirements specified in subclause 6.3.5.1 apply, wherein

- The Maximum output power requirements are specified in subclause 6.2.2E
- The Minimum output power requirements are specified in subclause 6.3.2
- The requirements for configured transmitted power are specified in subclause 6.2.5.

6.3.5E.2 Relative Power tolerance

The relative power tolerance requirements specified in subclause 6.3.5.2 apply, wherein

- The Maximum output power requirements are specified in subclause 6.2.2E
- The Minimum output power requirements are specified in subclause 6.3.2
- The requirements for configured transmitted power are specified in subclause 6.2.5.

6.3.5E.3 Aggregate power control tolerance

Aggregate power control tolerance is the ability of a UE to maintain its power in non-contiguous transmission in response to 0 dB TPC commands with respect to the first UE transmission, when the power control parameters specified in TS 36.213 are constant.

For category M1 TDD and FD-FDD UEs, the aggregate power control tolerance requirements specified in Table 6.3.5E.3.1-0 apply. For category M1 HD-FDD UEs and for continuous uplink transmissions of duration \leq 64 ms, the aggregate power control tolerance requirements specified in Table 6.3.5E.3.1-0 apply.

For category M1 HD-FDD UEs and for continuous uplink transmissions of duration > 64 ms, the aggregate power control tolerance requirements specified in Table 6.3.5E.3.1-1 apply.

6.3.5E.3.1 Minimum requirement

The category M1 TDD and FD-FDD UEs shall meet the requirements specified in Table 6.3.5E.3.1-0 for aggregate power control over the power range bounded by the minimum output power as defined in subclause 6.3.2, the maximum output power as defined in subclause 6.2.2E, and the requirements for configured transmitted power are specified in subclause 6.2.5.

The category M1 HD-FDD UEs and for continuous uplink transmissions of duration \leq 64 ms, shall meet the requirements specified in Table 6.3.5E.3.1-0 for aggregate power control over the power range bounded by the minimum output power as defined in subclause 6.3.2, the maximum output power as defined in subclause 6.2.2E, and the requirements for configured transmitted power are specified in subclause 6.2.5.

Table 6.3.5E.3.1-0: Aggregate power control tolerance

TPC con	nmand	UL channel	Aggregate power tolerance within 21 ms ²
0 dl	3	PUCCH	±2.5 dB
0 dl	3	PUSCH	±3.5 dB
NOTE 1:	For UE MHz / 2 after su For UE is 9 ms TPC co	E transmission gap is 4 ms for full-duplex FDD and TDD. For of half-duplex FDD with the channel bandwidth 5 MHz / 10 MHz / 15 to 6 half-duplex FDD with the channel bandwidth 5 MHz / 10 MHz / 15 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 6 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 6 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 6 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 6 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 6 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 6 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 6 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with the CBW 1.4 / 3 MHz, the transmission gap is 7 to 6 half-duplex FDD with	
NOTE 2:	For UE	E of half-duplex FDD with the CBW 1.4 / 3 MHz, the test interval is 41	

The category M1 HD-FDD UE and for continuous uplink transmissions of duration > 64 ms shall meet the requirements specified in Table 6.3.5E.3.1-1 for aggregate power control over the power range bounded by the minimum output power as defined in subclause 6.3.2 and the maximum output power as defined in subclause 6.2.2E.

Table 6.3.5E.3.1-1: Aggregate power control tolerance

TPC command	UL channel	Aggregate power tolerance within 129 ms
0 dB	PUCCH	±2.5 dB
0 dB PUSCH		±3.5 dB
NOTE: The UE transmission gap is 5 ms. TPC command is transmitted via MPDCCH 4 subframes preceding each PUCCH/ PUSCH transmission.		

6.3.5F Power Control for category NB1

Power control requirements in this clause apply for category NB1 UE.

6.3.5F.1 Absolute power tolerance

The minimum requirement for absolute power tolerance is given in Table 6.3.5F.1-1 over the power range bounded by the Maximum output power as defined in subclause 6.2.2F and the Minimum output power as defined in subclause 6.3.2F.

Table 6.3.5F.1-1: Absolute power tolerance - I

Conditions	Tolerance
Normal	± 9.0 dB
Extreme	±12.0 dB

In case of -15 dB \leq £s/Iot < -6 dB, the absolute power tolerance given in Table 6.3.5F.1-2 applies if the UE transmit power is not mandated to be $P_{\text{CMAX,c}}$ according to the UE uplink power control procedure or random access procedure in Section 16 of [6] (e.g. the lowest configured repetition level is used for NPRACH transmission or the number of repetitions of the allocated NPUSCH RUs is no more than 2).

Table 6.3.5F.1-2: Absolute power tolerance - II

Conditions	Tolerance
Normal	± 13.3 dB
Extreme	± 16.3 dB

6.3.5F.2 Relative power tolerance

Category NB1 UE relative power control requirement is defined for NPRACH power step values of 0, 2, 4 and 6 dB. For NPRACH transmission, the relative tolerance is the ability of the UE transmitter to set its output power relatively to the power of the most recently transmitted preamble. The measurement period for the NPRACH preamble is specified in Table 6.3.4F.2-1.

The requirements specified in Table 6.3.5F.2-1 apply when the power of the target and reference sub-frames are within the power range bounded by the Minimum output power as defined in subclause 6.3.2F and the maximum output power as defined in subclause 6.2.2F.

Table 6.3.5F.2-1: Relative power tolerance for category NB1 NPRACH transmission (normal conditions)

	step ∆P IB]	NPRACH [dB]
ΔΡ	= 0	±1.5
ΔΡ	= 2	±2.0
ΔΡ	= 4	±3.5
$\Delta P = 6$ ±4.0		±4.0
NOTE: For extreme conditions an additional ± 2.0 dB relaxation is allowed.		

The power step (ΔP) is defined as the difference in the calculated setting of the UE transmit power between the target and reference sub-frames. The error is the difference between ΔP and the power change measured at the UE antenna port with the power of the cell-specific reference signals kept constant. The error shall be less than the relative power tolerance specified in Table 6.3.5F.2-1.

6.3.5F.3 Aggregate power control tolerance for category NB1

Category NB1 aggregate power control tolerance is the ability of a UE to maintain its output power in non-contiguous transmission with respect to the first UE transmission, when the uplink power control parameters as defined in TS 36.213 are constant and α is set to 0.

6.3.5F.3.1 Minimum requirement

The UE shall meet the requirements specified in Table 6.3.5F.3.1-1 for aggregate power control over the power range bounded by the minimum output power as defined in subclause 6.3.2F and the maximum output power as defined in subclause 6.2.2F.

Table 6.3.5F.3.1-1: Aggregate power control tolerance

UL channel		Aggregate power tolerance		
		15 kHz / 12 tones within 53 ms	15 kHz / 1 tone within 104 ms	
NPU	PUSCH ±3.5 dB		5 dB	
NOTE:	For five consecutive UE transmissions the transmission gaps are 12 ms for 12 tone and 16 ms for single tone transmissions. Uplink scheduling grant is transmitted via NPDCCH eight subframes before NPUSCH transmission.			

6.4 Void

6.5 Transmit signal quality

6.5.1 Frequency error

The UE modulated carrier frequency shall be accurate to within ± 0.1 PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B

6.5.1A Frequency error for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the frequency error requirements defined in subclause 6.5.1 shall apply on each component carrier with all component carriers active.

For intra-band contiguous carrier aggregation the UE modulated carrier frequencies per band shall be accurate to within ± 0.1 PPM observed over a period of one timeslot compared to the carrier frequency of primary component carrier received from the E-UTRA in the corresponding band.

For intra-band non-contiguous carrier aggregation the requirements in Section 6.5.1 applies per component carrier.

6.5.1B Frequency error for UL-MIMO

For UE(s) supporting UL-MIMO, the UE modulated carrier frequency at each transmit antenna connector shall be accurate to within ± 0.1 PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B.

6.5.1D Frequency error for ProSe

The UE modulated carrier frequency for ProSe sidelink transmissions shall be accurate to within ± 0.1 PPM observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the synchronization source. The synchronization source can be E-UTRA Node B or a ProSe UE transmitting sidelink synchronization signals.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.5.1D apply for ProSe transmission and the requirements in subclause 6.5.1 apply for uplink transmission.

6.5.1E Frequency error for UE category M1

For category M1 TDD UEs and FD-FDD UEs, the frequency error requirements in Clause 6.5.1 apply.

For category M1 HD-FDD UEs and for continuous uplink transmissions of duration \leq 64 ms, the frequency error requirements in Clause 6.5.1 apply.

For category M1 HD-FDD UEs and for continuous uplink transmissions of duration > 64 ms, the UE modulated carrier frequency shall be accurate to within the limits in Table 6.5.1E-1 observed over a period of one time slot (0.5 ms) compared to the carrier frequency received from the E-UTRA Node B.

Table 6.5.1E-1: Frequency error requirement for HD-FDD UE category M1

Carrier frequency [GHz]	Frequency error [ppm]
≤1	±0.2
>1	±0.1

6.5.1F Frequency error for UE category NB1

For UE category NB1, the UE modulated carrier frequency shall be accurate to within the following limits

Table 6.5.1F-1: Frequency error requirement for UE category NB1

Carrier frequency [GHz]	Frequency error [ppm]
≤1	±0.2
>1	±0.1

Observed over a period of one time slot (0.5 ms for 15 kHz sub-carrier spacing and 2 ms excluding the 2304Ts gap for 3.75 kHz sub-carrier spacing) and averaged over $72/L_{Ctone}$ slots (where $L_{Ctone} = \{1, 3, 6, 12\}$ is the number of sub-carriers used for the transmission), compared to the carrier frequency received from the E-UTRA Node B.

6.5.2 Transmit modulation quality

Transmit modulation quality defines the modulation quality for expected in-channel RF transmissions from the UE. The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage
- In-band emissions for the non-allocated RB

All the parameters defined in subclause 6.5.2 are defined using the measurement methodology specified in Annex F.

6.5.2.1 Error Vector Magnitude

The Error Vector Magnitude is a measure of the difference between the reference waveform and the measured waveform. This difference is called the error vector. Before calculating the EVM the measured waveform is corrected by the sample timing offset and RF frequency offset. Then the carrier leakage shall be removed from the measured waveform before calculating the EVM.

The measured waveform is further modified by selecting the absolute phase and absolute amplitude of the Tx chain. The EVM result is defined after the front-end IDFT as the square root of the ratio of the mean error vector power to the mean reference power expressed as a %.

The basic EVM measurement interval in the time domain is one preamble sequence for the PRACH and is one slot for the PUCCH and PUSCH in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the EVM measurement interval is reduced by one symbol, accordingly. The PUSCH or PUCCH EVM measurement interval is also reduced when the mean power, modulation or allocation between slots is expected to change. In the case of PUSCH transmission, the measurement interval is reduced by a time interval equal to the sum of 5 μ s and the applicable exclusion period defined in subclause 6.3.4, adjacent to the boundary where the power change is expected to occur. The PUSCH exclusion period is applied to the signal obtained after the front-end IDFT. In the case of PUCCH transmission with power change, the PUCCH EVM measurement interval is reduced by one symbol adjacent to the boundary where the power change is expected to occur.

6.5.2.1.1 Minimum requirement

The RMS average of the basic EVM measurements for 10 sub-frames excluding any transient period for the average EVM case, and 60 sub-frames excluding any transient period for the reference signal EVM case, for the different modulations schemes shall not exceed the values specified in Table 6.5.2.1.1-1 for the parameters defined in Table 6.5.2.1.1-2. For EVM evaluation purposes, [all PRACH preamble formats 0-4 and] all PUCCH formats 1, 1a, 1b, 2, 2a and 2b are considered to have the same EVM requirement as QPSK modulated.

Table 6.5.2.1.1-1: Minimum requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level	Reference Signal EVM Level
QPSK or BPSK	%	17.5	17.5
16QAM	%	12.5	12.5
64QAM	%	8	8

Table 6.5.2.1.1-2: Parameters for Error Vector Magnitude

Parameter	Unit	Level
UE Output Power	dBm	≥ -40
Operating conditions		Normal conditions

6.5.2.2 Carrier leakage

Carrier leakage is an additive sinusoid waveform that has the same frequency as a modulated waveform carrier frequency. The measurement interval is one slot in the time domain.

6.5.2.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2.2.1-1.

Table 6.5.2.2.1-1: Minimum requirements for relative carrier leakage power

Parameters	Relative limit (dBc)	Applicable frequencies
Output power >10 dBm	-28	Carrier center frequency < 1 GHz
	-25	Carrier center frequency ≥ 1 GHz
0 dBm ≤ Output power ≤10 dBm	-25	
-30 dBm ≤ Output power ≤0 dBm	-20	
-40 dBm ≤ Output power < -30 dBm	-10	

6.5.2.3 In-band emissions

The in-band emission is defined as the average across 12 sub-carrier and as a function of the RB offset from the edge of the allocated UL transmission bandwidth. The in-band emission is measured as the ratio of the UE output power in a non-allocated RB to the UE output power in an allocated RB.

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

6.5.2.3.1 Minimum requirements

The relative in-band emission shall not exceed the values specified in Table 6.5.2.3.1-1.

Parameter description	Unit		Limit (NOTE 1)	Applicable Frequencies
General	dB	20	$ \text{ax} \left\{ -25 - 10 \cdot \log_{10} \left(N_{RB} / L_{CRB} \right), \\ $	Any non-allocated (NOTE 2)
	dB	-28	Image frequencies when carrier center frequency < 1 GHz and Output power > 10 dBm	Imaga
IQ Image		-25	Image frequencies when carrier center frequency < 1 GHz and Output power ≤ 10 dBm	Image frequencies (NOTES 2, 3)
			-25	Image frequencies when carrier center frequency ≥ 1 GHz
	dBc	-28	Output power > 10 dBm and carrier center frequency < 1 GHz	
Carrier leakage		-25	Output power > 10 dBm and carrier center frequency ≥ 1 GHz	Carrier frequency
		-25	0 dBm ≤ Output power ≤10 dBm	(NOTES 4, 5)
		-20	-30 dBm ≤ Output power ≤ 0 dBm	
		-10	-40 dBm ≤ Output power < -30 dBm	

Table 6.5.2.3.1-1: Minimum requirements for in-band emissions

- NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{RB} is defined in NOTE 10.
- NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one nonallocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs.
- NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the centre carrier frequency, but excluding any allocated RBs.
- NOTE 4: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one non-allocated RB to the measured total power in all allocated RBs.
- NOTE 5: The applicable frequencies for this limit are those that are enclosed in the RBs containing the DC frequency if N_{RB} is odd, or in the two RBs immediately adjacent to the DC frequency if N_{RB} is even, but excluding any allocated RB.
- NOTE 6: $L_{\it CRB}$ is the Transmission Bandwidth (see Figure 5.6-1).
- NOTE 7: $N_{\it RB}$ is the Transmission Bandwidth Configuration (see Figure 5.6-1).
- NOTE 8: EVM is the limit specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs.
- NOTE 9: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g.
 - $\Delta_{\it RB}=1$ or $\Delta_{\it RB}=-1$ for the first adjacent RB outside of the allocated bandwidth.
- NOTE 10: $P_{\rm RB}$ is the transmitted power per 180 kHz in allocated RBs, measured in dBm.

6.5.2.4 EVM equalizer spectrum flatness

The zero-forcing equalizer correction applied in the EVM measurement process (as described in Annex F) must meet a spectral flatness requirement for the EVM measurement to be valid. The EVM equalizer spectrum flatness is defined in terms of the maximum peak-to-peak ripple of the equalizer coefficients (dB) across the allocated uplink block. The basic measurement interval is the same as for EVM.

6.5.2.4.1 Minimum requirements

The peak-to-peak variation of the EVM equalizer coefficients contained within the frequency range of the uplink allocation shall not exceed the maximum ripple specified in Table 6.5.2.4.1-1 for normal conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 5 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 7 dB (see Figure 6.5.2.4.1-1).

The EVM equalizer spectral flatness shall not exceed the values specified in Table 6.5.2.4.1-2 for extreme conditions. For uplink allocations contained within both Range 1 and Range 2, the coefficients evaluated within each of these frequency ranges shall meet the corresponding ripple requirement and the following additional requirement: the relative difference between the maximum coefficient in Range 1 and the minimum coefficient in Range 2 must not be larger than 6 dB, and the relative difference between the maximum coefficient in Range 2 and the minimum coefficient in Range 1 must not be larger than 10 dB (see Figure 6.5.2.4.1-1).

Table 6.5.2.4.1-1: Minimum requirements for EVM equalizer spectrum flatness (normal conditions)

	Frequency range	Maximum ripple [dB]
F _{UL_Meas} – F	F _{UL_Low} ≥ 3 MHz and F _{UL_High} – F _{UL_Meas} ≥ 3 MHz	4 (p-p)
	(Range 1)	
F _{UL_Meas} –	Ful_Low < 3 MHz or Ful_High - Ful_Meas < 3 MHz	8 (p-p)
	(Range 2)	
	L_Meas refers to the sub-carrier frequency for which aluated	the equalizer coefficient is
NOTE 2: Ful 5.5	ւ_Low and Fut_High refer to each E-UTRA frequency 5-1	band specified in Table

Table 6.5.2.4.1-2: Minimum requirements for EVM equalizer spectrum flatness (extreme conditions)

	Frequency range	Maximum Ripple [dB]
F _{UL_Meas}	s – Ful_Low≥ 5 MHz and Ful_High – Ful_Meas≥ 5 MHz	4 (p-p)
	(Range 1)	
Ful_Mea	as - Ful_Low < 5 MHz or Ful_High - Ful_Meas < 5 MHz	12 (p-p)
	(Range 2)	
NOTE 1:	Ful_Meas refers to the sub-carrier frequency for which	the equalizer coefficient is
	evaluated	
NOTE 2:	Ful_Low and Ful_High refer to each E-UTRA frequency	band specified in Table
	5.5-1	

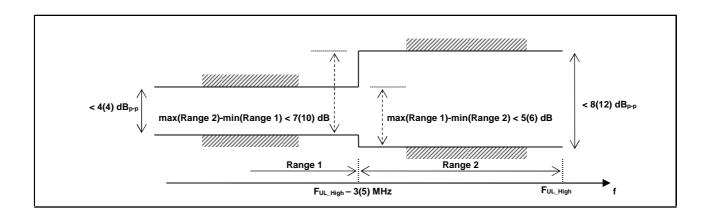


Figure 6.5.2.4.1-1: The limits for EVM equalizer spectral flatness with the maximum allowed variation of the coefficients indicated (the ETC minimum requirement within brackets).

6.5.2A Transmit modulation quality for CA

For inter-band carrier aggregation with uplink assigned to two E-UTRA bands, the requirements shall apply on each component carrier as defined in clause 6.5.2 with all component carriers active. If two contiguous component carriers are assigned to one E-UTRA band, the requirements in subclauses 6.5.2A.1, 6.5.2A.2, and 6.5.2A.3 apply for those component carriers.

The requirements in this clause apply with PCC and SCC in the UL configured and activated: PCC with PRB allocation and SCC without PRB allocation and without CSI reporting and SRS configured.

6.5.2A.1 Error Vector Magnitude

For the intra-band contiguous and non-contiguous carrier aggregation, the Error Vector Magnitude requirement should be defined for each component carrier. Requirements only apply with PRB allocation in one of the component carriers. Similar transmitter impairment removal procedures are applied for CA waveform before EVM calculation as is specified for non-CA waveform in sub-section 6.5.2.1.

When a single component carrier is configured Table 6.5.2.1.1-1 apply.

The EVM requirements are according to Table 6.5.2A.1-1 if CA is configured in uplink.

Table 6.5.2A.1-1: Minimum requirements for Error Vector Magnitude

Parameter	Unit	Average EVM Level per CC	Reference Signal EVM Level
QPSK or BPSK	%	17.5	17.5
16QAM	%	12.5	12.5
64QAM	%	8	8

6.5.2A.2 Carrier leakage for CA

Carrier leakage is an additive sinusoid waveform that is confined within the aggrecated transmission bandwidth configuration. The carrier leakage requirement is defined for each component carrier and is measured on the component carrier with PRBs allocated. The measurement interval is one slot in the time domain.

6.5.2A.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power shall not exceed the values specified in Table 6.5.2A.2.1-1.

Table 6.5.2A.2.1-1: Minimum requirements for Relative Carrier Leakage Power

Parameters	Relative Limit (dBc)
Output power >0 dBm	-25
-30 dBm ≤ Output power ≤0 dBm	-20
-40 dBm ≤ Output power < -30 dBm	-10

6.5.2A.3 In-band emissions

6.5.2A.3.1 Minimum requirement for CA

For intra-band contiguous carrier aggregation bandwidth class B and C, the requirements in Table 6.5.2A.3.1-1 and 6.5.2A.3.1-2 apply within the aggregated transmission bandwidth configuration with both component carrier (s) active and one single contiguous PRB allocation of bandwidth L_{CRB} at the edge of the aggregated transmission bandwidth configuration.

The inband emission is defined as the interference falling into the non allocated resource blocks for all component carriers. The measurement method for the inband emissions in the component carrier with PRB allocation is specified in annex F. For a non allocated component carrier a spectral measurement is specified.

For intra-band non-contiguous carrier aggregation the requirements for in-band emissions should be defined for each component carrier. Requirements only apply with PRB allocation in one of the component carriers according to Table 6.5.2.3.1.

Table 6.5.2A.3.1-1: Minimum requirements for in-band emissions (allocated component carrier)

Parameter	Unit		Limit	Applicable Frequencies	
		$\max \{ -1 \}$	$25 - 10 \cdot \log_{10} (N_{RB} / L_{CRB}),$		
General	dB	20 · log 10	$EVM - 3 - 5 \cdot (\left \Delta_{RB}\right - 1) / L_{CRB},$	Any non-allocated (NOTE 2)	
			$/180kHz-P_{RB}$		
IQ Image	dB		-25	Exception for IQ image (NOTE 3)	
Camian		-25	Output power > 0 dBm		
Carrier	dBc	-20	-30 dBm ≤ Output power ≤ 0 dBm	Exception for Carrier frequency (NOTE 4)	
leakage		-10	-40 dBm ≤ Output power < -30 dBm	(NOTE 4)	

- NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated RB. For each such RB, the minimum requirement is calculated as the higher of P_{RB} 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{RB} is defined in NOTE 9. The limit is evaluated in each non-allocated RB.
- NOTE 2: The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in one nonallocated RB to the measured average power per allocated RB, where the averaging is done across all allocated RBs
- NOTE 3: Exceptions to the general limit are allowed for up to $L_{\it CRBs}$ +1 RBs within a contiguous width of $L_{\it CRBs}$ +1 non-allocated RBs. The measurement bandwidth is 1 RB.
- NOTE 4: Exceptions to the general limit are allowed for up to two contiguous non-allocated RBs. The measurement bandwidth is 1 RB and the limit is expressed as a ratio of measured power in the non-allocated RB to the measured total power in all allocated RBs.
- NOTE 5: $L_{\it CRB}$ is the Transmission Bandwidth (see Figure 5.6-1) not exceeding $\lfloor N_{\it RB}/2-1 \rfloor$
- NOTE 6: $N_{\it RB}$ is the Transmission Bandwidth Configuration (see Figure 5.6-1) of the component carrier with RBs allocated.
- NOTE 7: EVM is the limit specified in Table 6.5.2.1.1-1 for the modulation format used in the allocated RBs.
- NOTE 8: Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ or $\Delta_{RB}=-1$ for the first adjacent RB outside of the allocated bandwidth).
- NOTE 9: P_{RR} is the transmitted power per 180 kHz in allocated RBs, measured in dBm.

Table 6.5.2A.3.1-2: Minimum requirements for in-band emissions (not allocated component carrier)

Para- meter	Unit	Meas BW NOTE 1		Limit	remark	Applicable Frequencies
General	dΒ	BW of 1 RB (180KHz rectangular)	20 · log 10	$25 - 10 \cdot \log_{10}(N_{RB} / L_{CRB}),$ $EVM - 3 - 5 \cdot (\Delta_{RB} - 1) / L_{CRB},$ $e / 180 kHz - P_{RB}$	The reference value is the average power per allocated RB in the allocated component carrier	Any RB in the non allocated component carrier. The frequency raster of the RBs is derived when this component carrier is allocated with RBs
IQ Image	dB	BW of 1 RB (180KHz rectangular)		-25 NOTE 2	The reference value is the average power per allocated RB in the allocated component carrier	The frequencies of the $L_{\it CRB}$ contiguous non-allocated RBs are unknown. The frequency raster of the RBs is derived when this component carrier is allocated with RBs
		BW of 1 RB (180KHz		NOTE 3	The reference	The frequencies of
	rectangular)		-25	Output power > 0 dBm	value is the total power	the up to 2 non-allocated
Carrier leakage		-20	-30 dBm ≤ Output power ≤ 0 dBm	of the allocated RBs in the allocated component carrier	RBs are unknown. The frequency raster of the RBs is derived when this	
NOTE1: I	2	DW-	-10	-40 dBm ≤ Output power < -30 dBm		component carrier is allocated with RBs

NOTE1: Resolution BWs smaller than the measurement BW may be integrated to achieve the measurement bandwidth.

NOTE 2: Exceptions to the general limit is are allowed for up to $L_{\it CRB}$ +1 RBs within a contiguous width of $L_{\it CRB}$ +1 non-allocated RBs.

NOTE 3: Two Exceptions to the general limit are allowed for up to two contiguous non-allocated RBs

NOTE 4: NOTES 1, 5, 6, 7, 8, 9 from Table 6.5.2A.3.1-1 apply for Table 6.5.2A.3.1-2 as well.

NOTE 5: Δ_{RB} for measured non-allocated RB in the non allocated component carrier may take non-integer values when the carrier spacing between the CCs is not a multiple of RB.

6.5.2B Transmit modulation quality for UL-MIMO

For UE supporting UL-MIMO, the transmit modulation quality requirements are specified at each transmit antenna connector.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.5.2 apply.

The transmit modulation quality is specified in terms of:

- Error Vector Magnitude (EVM) for the allocated resource blocks (RBs)
- EVM equalizer spectrum flatness derived from the equalizer coefficients generated by the EVM measurement process
- Carrier leakage (caused by IQ offset)
- In-band emissions for the non-allocated RB

6.5.2B.1 Error Vector Magnitude

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Error Vector Magnitude requirements specified in Table 6.5.2.1.1-1 which is defined in subclause 6.5.2.1 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

6.5.2B.2 Carrier leakage

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the Relative Carrier Leakage Power requirements specified in Table 6.5.2.2.1-1 which is defined in subclause 6.5.2.2 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

6.5.2B.3 In-band emissions

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the In-band Emission requirements specified in Table 6.5.2.3.1-1 which is defined in subclause 6.5.2.3 apply at each transmit antenna connector. The requirements shall be met with the uplink MIMO configurations specified in Table 6.2.2B-2.

6.5.2B.4 EVM equalizer spectrum flatness for UL-MIMO

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the EVM Equalizer Spectrum Flatness requirements specified in Table 6.5.2.4.1-1 and Table 6.5.2.4.1-2 which are defined in subclause 6.5.2.4 apply at each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

6.5.2D Transmit modulation quality for ProSe

The requirements in this clause apply to ProSe sidelink transmissions.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.5.2D apply for ProSe transmission and the requirements in subclause 6.5.2 apply for uplink transmission.

6.5.2D.1 Error Vector Magnitude

For ProSe sidelink physical channels PSDCH, PSCCH, PSSCH, and PSBCH, the Error Vector Magnitude requirements shall be as specified for PUSCH in subclause 6.5.2.1 for the corresponding modulation and transmission bandwidth. When ProSe transmissions are shortened due to transmission gap of 1 symbol at the end of the subframe, the EVM measurement interval is reduced by one symbol, accordingly.

For PSBCH the duration over which EVM is averaged shall be 24 subframes.

This requirement is not applicable for ProSe physical signals PSSS and SSSS.

6.5.2D.2 Carrier leakage

The requirements of subcaluse 6.5.2.2 shall apply for ProSe transmissions.

6.5.2D.3 In-band emissions

For ProSe sidelink physical channels PSDCH, PSCCH, PSSCH, and PSBCH, the In-band emissions requirements shall be as specified for PUSCH in subclause 6.5.2.3 for the corresponding modulation and transmission bandwidth. When ProSe transmissions are shortened due to transmission gap of 1 symbol at the end of the subframe, the In-band emissions measurement interval is reduced by one symbol, accordingly.

6.5.2D.4 EVM equalizer spectrum flatness for ProSe

The requirements of subcaluse 6.5.2.4 shall apply for ProSe transmissions.

6.5.2E Transmit modulation quality for category M1

For UE of UL Category M1, the requirements shall apply as defined in clause 6.5.2.

6.5.2E.1 Error Vector Magnitude

The Error Vector Magnitude is defined in section 6.5.2.1.

6.5.2E.2 Carrier leakage

Carrier leakage is an additive sinusoid waveform that has the same frequency as a modulated waveform carrier frequency. For UE of UL Category M1, the sinusoid waveform may alternatively lie at the center of the 6 RB narrowband assigned for transmission. The measurement interval is one slot in the time domain.

6.5.2E.2.1 Minimum requirements

The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power at the center of the channel bandwidth or the 6 RB narrowband assigned for transmission shall not exceed the values specified in Table 6.5.2.2.1-1.

6.5.2E.3 In-band emissions

The in-band emission is defined in clause 6.5.2.3.

6.5.2E.3.1 Minimum requirements

The relative in-band emission when center carrier frequency is at the center of channel bandwidth or when at the 6RB narrowband assigned for transmission shall not exceed the values specified in Table 6.5.2E.3.1-1

Table 6.5.2E.3.1-1: Minimum requirements for in-band emissions

Parameter description	Unit		Applicable Frequencies	
General	dB	20		Any non-allocated (NOTE 2)
	dB	-28	Image frequencies when carrier center frequency < 1 GHz and Output power > 10 dBm	lmaga
IQ Image		-25	Image frequencies when carrier center frequency < 1 GHz and Output power ≤ 10 dBm	Image frequencies (NOTES 2, 3)
			-25	Image frequencies when carrier center frequency ≥ 1 GHz
	dBc	-28	Output power > 10 dBm and carrier center frequency < 1 GHz	
Carrier leakage		-25	Output power > 10 dBm and carrier center frequency ≥ 1 GHz	Carrier frequency (NOTES 4, 5)
		-25	0 dBm ≤ Output power ≤10 dBm	
		-20	-30 dBm ≤ Output power ≤ 0 dBm	

		-10	-40 dBm ≤ Output power < -30 dBm					
NOTE 1:	An in-band emissio	ns combined lim	nit is evaluated in each non-allocated RB. For each s	uch RB, the				
	minimum requirement is calculated as the higher of P_{RB} - 30 dB and the power sum of all limit values							
			age) that apply. P_{RB} is defined in NOTE 10.					
NOTE 2:			RB and the limit is expressed as a ratio of measured					
	allocated RB to the allocated RBs.	measured aver	age power per allocated RB, where the averaging is	done across all				
NOTE 3:	The applicable freq	uencies for this	limit are those that are enclosed in the reflection of the	ne allocated				
			h respect to the centre carrier frequency, but excludi					
		• •	pplicable frequencies shall alternatively include those	e found by reflection				
			narrowband, but excluding any allocated RBs.					
NOTE 4:			RB and the limit is expressed as a ratio of measured	power in one non-				
NOTE 5			power in all allocated RBs.					
NOTE 5:			limit are those that are enclosed in the RBs containing	•				
	frequency if $N_{\it RB}$ is	s odd, or in the t	two RBs immediately adjacent to the DC frequency if	$^{\circ}$ $N_{_{RB}}$ is even, but				
	excluding any allocathe centre frequence		E of UL Category M1, the applicable frequencies sha ed 6RBs.	Il alternatively be				
NOTE 6:	$L_{\it CRB}$ is the Transr	nission Bandwid	dth (see Figure 5.6-1).					
NOTE 7:	$N_{{\scriptscriptstyle RB}}$ is the Transm	nission Bandwid	th Configuration (see Figure 5.6-1).					
NOTE 8:	EVM is the limit:	specified in Tab	le 6.5.2.1.1-1 for the modulation format used in the a	Illocated RBs.				
NOTE 9:	$\Delta_{\it RB}$ is the starting	frequency offse	t between the allocated RB and the measured non-a	Illocated RB (e.g.				
	$\Delta_{\it RB}=1$ or $\Delta_{\it RB}=1$	=-1 for the firs	t adjacent RB outside of the allocated bandwidth.					

6.5.2F Transmit modulation quality for Category NB1

NOTE 10: P_{RB} is the transmitted power per 180 kHz in allocated RBs, measured in dBm.

6.5.2F.1 Error Vector Magnitude

The RMS average of the basic EVM measurements for $240/L_{Ctone}$ slots excluding any transient period for the average EVM case, where $L_{Ctone} = \{1, 3, 6, 12\}$ is the number of subcarriers for the category NB1 transmission, for the different modulations schemes shall not exceed the values specified in Table 6.5.2.1.1-1 for the parameters defined in Table 6.5.2.1.1-2. For EVM evaluation purposes, both NPRACH formats are considered to have the same EVM requirement as QPSK modulated.

6.5.2F.2 Carrier leakage

Carrier leakage is an additive sinusoid waveform that has the same frequency as a modulated waveform carrier frequency. The measurement interval is one slot in the time domain. The relative carrier leakage power is a power ratio of the additive sinusoid waveform and the modulated waveform. The relative carrier leakage power of category NB1 UE shall not exceed the values specified in Table 6.5.2F.2-1.

Table 6.5.2F.2-1: Minimum requirements for relative carrier leakage power

Parameters	Relative limit (dBc)
0 dBm ≤ Output power	-25
-30 dBm ≤ Output power ≤ 0 dBm	-20
-40 dBm ≤ Output power < -30 dBm	-10

6.5.2F.3 In-band emissions

The in-band emission is defined as a function of the tone offset from the edge of the allocated UL transmission tone(s) within the transmission bandwidth configuration. The in-band emission is measured as the ratio of the UE output power in a non–allocated tone to the UE output power in an allocated tone. The basic in-band emissions measurement interval is defined over one slot in the time domain.

The category NB1 UE relative in-band emission shall not exceed the values specified in Table 6.5.2F.3-1.

Parameter description	Unit		Limit (NOTE 1)	Applicable Frequencies
General	dB	-18 -	$-15 - 10 \cdot \log_{10}(N_{tone} / L_{Ctone}),$ $5 \cdot (\left \Delta_{tone}\right - 1) / L_{Ctone},$ $Bm / (3.75 kHz \ or \ 15 kHz) - P_{tone} $	Any non-allocated (NOTE 2)
IQ Image	dB		-25	Image frequencies (NOTES 2, 3)
Carrier leakage	dBc	-25 -20 -10	0 dBm ≤ Output power -30 dBm ≤ Output power ≤ 0 dBm -40 dBm ≤ Output power < -30 dBm	Carrier frequency (NOTES 4, 5)

Table 6.5.2F.3-1: Minimum requirements for in-band emissions

- NOTE 1: An in-band emissions combined limit is evaluated in each non-allocated tone. For each such tone, the minimum requirement is calculated as the higher of P_{tone} 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply. P_{tone} is defined in NOTE 9.
- NOTE 2: The measurement bandwidth is 1 tone and the limit is expressed as a ratio of measured power in one nonallocated tone to the measured average power per allocated tone, where the averaging is done across all allocated tones.
- NOTE 3: The applicable frequencies for this limit are those that are enclosed in the reflection of the allocated bandwidth, based on symmetry with respect to the centre carrier frequency, but excluding any allocated tones.
- NOTE 4: The measurement bandwidth is 1 tone and the limit is expressed as a ratio of measured power in one nonallocated tone to the measured total power in all allocated tones.
- NOTE 5: The applicable frequencies for this limit are those that are enclosed in the tones containing the DC frequency if N_{tone} is odd, or in the two tones immediately adjacent to the DC frequency if N_{tone} is even, but excluding any allocated tone.
- NOTE 6: L_{Ctone} is the Transmission Bandwidth (tones).
- NOTE 7: N_{tone} is the Transmission Bandwidth Configuration (tones).
- NOTE 8: Δ_{tone} is the starting frequency offset between the allocated tone and the measured non-allocated tone. (e.g. $\Delta_{tone}=1$ or $\Delta_{tone}=-1$ for the first adjacent tone outside of the allocated bandwidth.
- NOTE 9: P_{tone} is the transmitted power per 3.75 kHz or 15 kHz in allocated tones, measured in dBm.

6.6 Output RF spectrum emissions

The output UE transmitter spectrum consists of the three components; the emission within the occupied bandwidth (channel bandwidth), the Out Of Band (OOB) emissions and the far out spurious emission domain.

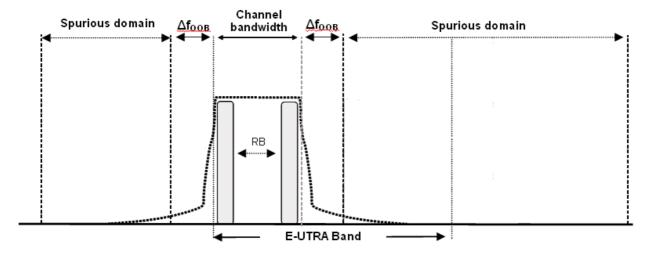


Figure 6.6-1: Transmitter RF spectrum

6.6.1 Occupied bandwidth

Occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel. The occupied bandwidth for all transmission bandwidth configurations (Resources Blocks) shall be less than the channel bandwidth specified in Table 6.6.1-1

Occupied channel bandwidth / Channel bandwidth 3.0 MHz MHz MHz MHz MHz MHz Channel bandwidth 1.4 3 5 10 15 20 (MHz)

Table 6.6.1-1: Occupied channel bandwidth

6.6.1A Occupied bandwidth for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands the occupied bandwidth is defined per component carrier. Occupied bandwidth is the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on assigned channel bandwidth on the component carrier. The occupied bandwidth shall be less than the channel bandwidth specified in Table 6.6.1-1.

For intra-band contiguous carrier aggregation the occupied bandwidth is a measure of the bandwidth containing 99 % of the total integrated power of the transmitted spectrum. The OBW shall be less than the aggregated channel bandwidth defined in subclause 5.6A.

For intra-band non-contiguous carrier aggregation sub-block occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the sub-block. In case the sub-block consist of one component carrier the occupied bandwidth of the sub-block shall be less than the channel bandwidth specified in Table 6.6.1-1.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the occupied bandwidth is the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on each E-UTRA band. The OBW shall be less than the channel bandwidth as specified in Table 6.6.1-1 for the E-UTRA band supporting one component carrier. The OBW shall be less than the aggregated channel bandwidth as specified in subclause 5.6A for the E-UTRA band supporting two contiguous component carriers.

6.6.1B Occupied bandwidth for UL-MIMO

For UE supporting UL-MIMO, the requirements for occupied bandwidth is specified at each transmit antenna connector. The occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel at each transmit antenna connector.

For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the occupied bandwidth at each transmitter antenna shall be less than the channel bandwidth specified in Table 6.6.1B-1. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

Table 6.6.1B-1: Occupied channel bandwidth

Occupied channel bandwidth / Channel l

	Occupied c	Occupied channel bandwidth / Channel bandwidth				
	1.4 3.0 5 10 15 20 MHz MHz MHz MHz MHz MHz					
Channel bandwidth (MHz)	1.4	3	5	10	15	20

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.6.1 apply.

6.6.1F Occupied bandwidth for category NB1

The occupied bandwidth is defined as the bandwidth containing 99 % of the total integrated mean power of the transmitted spectrum on the assigned channel at the transmit antenna connector. Occupied bandwidth shall be less than the channel bandwidth of category NB1 specified in Section 5.6F.

6.6.2 Out of band emission

The Out of band emissions are unwanted emissions immediately outside the assigned channel bandwidth resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. This out of band emission limit is specified in terms of a spectrum emission mask and an Adjacent Channel Leakage power Ratio.

6.6.2.1 Spectrum emission mask

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the \pm edge of the assigned E-UTRA channel bandwidth. For frequencies greater than (Δf_{OOB}) as specified in Table 6.6.2.1.1-1 the spurious requirements in subclause 6.6.3 are applicable.

6.6.2.1.1 Minimum requirement

The power of any UE emission shall not exceed the levels specified in Table 6.6.2.1.1-1 for the specified channel bandwidth.

Spectrum emission limit (dBm)/ Channel bandwidth									
Δf _{OOB} (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth		
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz		
± 1-2.5	-10	-10	-10	-10	-10	-10	1 MHz		
± 2.5-2.8	-25	-10	-10	-10	-10	-10	1 MHz		
± 2.8-5		-10	-10	-10	-10	-10	1 MHz		
± 5-6		-25	-13	-13	-13	-13	1 MHz		
± 6-10			-25	-13	-13	-13	1 MHz		
± 10-15				-25	-13	-13	1 MHz		
± 15-20					-25	-13	1 MHz		
+ 20-25						-25	1 MHz		

Table 6.6.2.1.1-1: General E-UTRA spectrum emission mask

NOTE:

As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.2.1A Spectrum emission mask for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the spectrum emission mask of the UE is defined per component carrier while both component carriers are active and the requirements are specified in subclauses 6.6.2.1 and 6.6.2.2. If for some frequency spectrum emission masks of component carriers overlap then spectrum emission mask allowing higher power spectral density applies for that frequency. If for some frequency a component carrier spectrum emission mask overlaps with the channel bandwidth of another component carrier, then the emission mask does not apply for that frequency.

For intra-band contiguous carrier aggregation the spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the \pm edge of the aggregated channel bandwidth (Table 5.6A-1) For intra-band contiguous carrier aggregation the bandwidth class B and C, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.1A-0 and Table 6.6.2.1A-1 for the specified channel bandwidth.

Table 6.6.2.1A-0: General E-UTRA CA spectrum emission mask for Bandwidth Class B

Spectrum emission limit [dBm]/BW _{Channel CA}								
<u>Δf_{OOB}</u> (MHz)	25RB+50RB (14.95 MHz)	50RB+50RB (19.9 MHz)	Measurement bandwidth					
± 0-1	-20	-21	30 kHz					
± 1-5	-10	-10	1 MHz					
± 5-14.95	-13	-13	1 MHz					
± 14.95-19.90	-25	-13	1 MHz					
± 19.90-19.95	-25	-25	1 MHz					
± 19.95-24.90		-25	1 MHz					

Table 6.6.2.1A-1: General E-UTRA CA spectrum emission mask for Bandwidth Class C

		Spe	ctrum emission	limit [dBm]/BWc	hannel_CA		
Δf _{OOB} (MHz)	25RB+100RB (24.95MHz)	50RB+75RB (24.75 MHz)	50RB+100RB (29.9 MHz)	75RB+75RB (30 MHz)	75RB+100RB (34.85 MHz)	100RB+100RB (39.8 MHz)	Measurement bandwidth
± 0-1	-22	-22	-22.5	-22.5	-23.5	-24	30 kHz
± 1-5	-10	-10	-10	-10	-10	-10	1 MHz
± 5-24.75	-13	-13	-13	-13	-13	-13	1 MHz
± 24.75-	-13	-25	-13	-13	-13	-13	1 MHz
24.95							
± 24.95-	-25	-25	-13	-13	-13	-13	1 MHz
29.75							
± 29.75-29.9	-25		-13	-13	-13	-13	1 MHz
± 29.9-29.95	-25		-25	-13	-13	-13	1 MHz
± 29.95-30			-25	-13	-13	-13	1 MHz
± 30-34.85			-25	-25	-13	-13	1 MHz
± 34.85-34.9			-25	-25	-25	-13	1 MHz
± 34.9-35				-25	-25	-13	1 MHz
± 35-39.8					-25	-13	1 MHz
± 39.8-39.85					-25	-25	1 MHz
± 39.85-44.8						-25	1 MHz

For intra-band non-contiguous carrier aggregation transmission the spectrum emission mask requirement is defined as a composite spectrum emissions mask. Composite spectrum emission mask applies to frequencies up to \pm Δf_{OOB} starting from the edges of the sub-blocks. Composite spectrum emission mask is defined as follows

- a) Composite spectrum emission mask is a combination of individual sub-block spectrum emissions masks
- b) In case the sub-block consist of one component carrier the sub-lock general spectrum emission mask is defined in subclause 6.6.2.1.1
- c) If for some frequency sub-block spectrum emission masks overlap then spectrum emission mask allowing higher power spectral density applies for that frequency
- d) If for some frequency a sub-block spectrum emission mask overlaps with the sub-block bandwidth of another sub-block, then the emission mask does not apply for that frequency.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the spectrum emission mask of the UE is defined per E-UTRA band while all component carriers are active. For the E-UTRA band supporting one component carrier the requirements in subclauses 6.6.2.1 and 6.6.2.2 apply. For the E-UTRA band supporting two contiguous component carriers the requirements specified in subclause 6.6.2.1A apply. If for some frequency spectrum emission masks of single component carrier and two contiguous component carriers overlap then spectrum emission mask allowing higher power spectral density applies for that frequency. If for some frequency spectrum emission masks of single component carrier or two contiguous component carriers overlap then the emission mask does not apply for that frequency.

6.6.2.2 Additional spectrum emission mask

This requirement is specified in terms of an "additional spectrum emission" requirement.

6.6.2.2.1 Minimum requirement (network signalled value "NS_03", "NS_11", "NS_20", and "NS_21")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS_03", "NS_11", "NS_20" or "NS_21" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.1-1.

	Spectrum emission limit (dBm)/ Channel bandwidth							
Δf _{ООВ} (MHz)	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth	
± 0-1	-10	-13	-15	-18	-20	-21	30 kHz	
± 1-2.5	-13	-13	-13	-13	-13	-13	1 MHz	
± 2.5-2.8	-25	-13	-13	-13	-13	-13	1 MHz	
± 2.8-5		-13	-13	-13	-13	-13	1 MHz	
± 5-6		-25	-13	-13	-13	-13	1 MHz	
± 6-10			-25	-13	-13	-13	1 MHz	
± 10-15				-25	-13	-13	1 MHz	
± 15-20					-25	-13	1 MHz	
± 20-25						-25	1 MHz	

Table 6.6.2.2.1-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.2.2.2 Minimum requirement (network signalled value "NS_04")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.2-1.

	Spectrum emission limit (dBm)/ Channel bandwidth								
Δf _{OOB} (MHz)	5 MHz	10 MHz	15 MHz	20 MHz	Measurement bandwidth				
± 0-1	-15	-18	-20	-21	30 kHz				
± 1-2.5	-10	-10	-10	-10	1 MHz				
± 2.5-2.8	-10	-10	-10	-10	1 MHz				
± 2.8-5	-10	-10	-10	-10	1 MHz				
± 5-6	-13	-13	-13	-13	1 MHz				
± 6-9	-25	-13	-13	-13	1 MHz				
± 9-10	-25	-25	-13	-13	1 MHz				
± 10-13.5		-25	-13	-13	1 MHz				
± 13.5-15		-25	-25	-13	1 MHz				
± 15-18			-25	-13	1 MHz				
± 18-20			-25	-25	1 MHz				
± 20-25				-25	1 MHz				

Table 6.6.2.2.2-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.2.2.3 Minimum requirement (network signalled value "NS_06" or "NS_07")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "NS 06" or "NS 07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2.3-1.

Spectrum emission limit (dBm)/ Channel bandwidth Δfooв 3.0 Measurement MHz MHz MHz bandwidth (MHz) MHz -13 -18 30 kHz -13 -15 $\pm 0 - 0.1$ -13 -13 -13 100 kHz -13 $\pm 0.1-1$ -13 -13 -13 -13 1 MHz $\pm 1 - 2.5$ -25 -13 -13 -13 1 MHz ± 2.5-2.8 -13 -13 -13 1 MHz $\pm 2.8-5$ <u>± 5</u>-6 -25 -13 -13 1 MHz -25 -13 1 MHz $\pm 6 - 10$ -25 \pm 10-15 1 MHz

Table 6.6.2.2.3-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.2.2A Additional Spectrum Emission Mask for CA

 \pm 32.85-34.9

 $\pm 34.9 - 35$

 \pm 35-37.8

 \pm 37.8-39.85

± 39.85-44.8

This requirement is specified in terms of an "additional spectrum emission" requirement.

6.6.2.2A.1 Minimum requirement (network signalled value "CA_NS_04")

Additional spectrum emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

When "CA_NS_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.2.2A.1-1.

Spectrum emission limit [dBm]/BWChannel_CA 75+100RB Δfоов 50+75RB 25+100RB 50+100RB 75+75RB 100+100RB Measurement (MHz) (24.75 MHz) (24.95 MHz) (29.9 MHz) (30 MHz) (34.85 MHz) (39.8 MHz) bandwidth ± 0-1 -22 -22.5 -23 -23.5 -24 30 kHz -10 -10 -10 -10 -10 -10 1 MHz ± 1-5 -13 -13 -13 -13 -13 -13 1 MHz $\pm 5 - 22.95$ -13 -25 -13 -13 -13 -13 1 MHz \pm 22.95-23.25 -25 -25 -13 -13 -13 1 MHz ±23.25-27.9 -13 \pm 27.9-28.5 -25 -25 -25 -13 -13 -13 1 MHz -25 -25 -25 -25 -13 -13 1 MHz \pm 28.5-29.75 -25 -25 -25 -13 -13 1 MHz \pm 29.75-29.95 -25 -25 -13 -13 1 MHz \pm 29.95-32.85 -25 -25 1 MHz

-25

-25

-25

-25

-25

-13

-13

-13

-25

-25

1 MHz

1 MHz

1 MHz

1 MHz

Table 6.6.2.2A.1-1: Additional requirements

NOTE: As a general rule, the resolution bandwidth of the measuring equipment should be equal to the measurement bandwidth. However, to improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.2.3 Adjacent Channel Leakage Ratio

Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency. ACLR requirements for one E-UTRA carrier are specified for two scenarios for an adjacent E-UTRA and /or UTRA channel as shown in Figure 6.6.2.3-1.

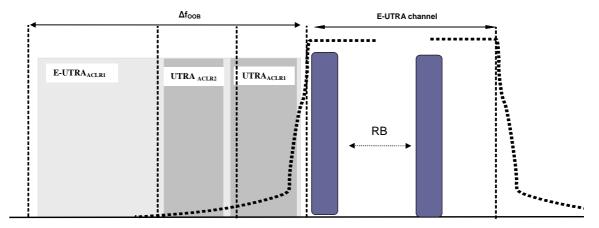


Figure 6.6.2.3-1: Adjacent Channel Leakage requirements for one E-UTRA carrier

6.6.2.3.1 Minimum requirement E-UTRA

E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA $_{ACLR}$) is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. The assigned E-UTRA channel power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.1-1 and Table 6.6.2.3.1-2. If the measured adjacent channel power is greater than -50 dBm then the E-UTRA $_{ACLR}$ shall be higher than the value specified in Table 6.6.2.3.1-1 and Table 6.6.2.3.1-2.

	Char	Channel bandwidth / E-UTRA _{ACLR1} / Measurement bandwidth						
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
E-UTRA _{ACLR1}	30 dB	30 dB	30 dB	30 dB	30 dB	30 dB		
E-UTRA channel Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz		
Adjacent channel	+1.4	+3.0	+5	+10	+15	+20		
centre frequency	/	/	/	/	/	/		
offset [MHz]	-1.4	-3.0	-5	-10	-15	-20		

Table 6.6.2.3.1-1: General requirements for E-UTRA_{ACLR}

Table 6.6.2.3.1-2: Additional E-UTRA_{ACLR} requirements for Power Class 1

	Channel bandwidth / E-UTRA _{ACLR1} / Measurement bandwidth						
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
E-UTRA _{ACLR1}			37 dB	37 dB			
E-UTRA channel Measurement bandwidth			4.5 MHz	9.0 MHz			
Adjacent channel centre frequency offset [MHz]			+5 / -5	+10 / -10			
NOTE 1: E-UTRAAC	LR1 shall be	applicab	le for >23dBm				

6.6.2.3.1A Void

6.6.2.3.1Aa Void

6.6.2.3.2 Minimum requirements UTRA

UTRA Adjacent Channel Leakage power Ratio (UTRA $_{ACLR}$) is the ratio of the filtered mean power centred on the assigned E-UTRA channel frequency to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

UTRA adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA $_{ACLR1}$) and the 2^{nd} UTRA adjacent channel (UTRA $_{ACLR2}$). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor α =0.22. The assigned E-UTRA channel power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2-1. If the measured UTRA channel power is greater than –50dBm then the UTRA $_{ACLR}$ shall be higher than the value specified in Table 6.6.2.3.2-1.

Table 6.6.2.3.2-1: Requirements for UTRA_{ACLR1/2}

	Channel bandwidth / UTRA _{ACLR1/2} / Measurement bandwidth							
	1.4	3.0	5	10	15	20		
	MHz	MHz	MHz	MHz	MHz	MHz		
UTRA _{ACLR1}	33 dB	33 dB	33 dB	33 dB	33 dB	33 dB		
Adjacent channel centre frequency offset [MHz]	0.7+BWutra/2 / -0.7- BWutra/2	1.5+BW _{UTRA} /2 / -1.5- BW _{UTRA} /2	+2.5+BW _{UTRA} /2 / -2.5-BW _{UTRA} /2	+5+BWutra/2 / -5-BWutra/2	+7.5+BWutra/2 / -7.5-BWutra/2	+10+BWutra/2 / -10-BWutra/2		
UTRA _{ACLR2}	-	-	36 dB	36 dB	36 dB	36 dB		
Adjacent channel centre frequency offset [MHz]	-	-	+2.5+3*BWutra/2 / -2.5-3*BWutra/2	+5+3*BWutra/2 / -5-3*BWutra/2	+7.5+3*BWutra/2 / -7.5-3*BWutra/2	+10+3*BWutra/2 / -10-3*BWutra/2		
E-UTRA channel Measurement bandwidth	1.08 MHz	2.7 MHz	4.5 MHz	9.0 MHz	13.5 MHz	18 MHz		
UTRA 5MHz channel Measurement bandwidth (NOTE 1)	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz	3.84 MHz		
UTRA 1.6MHz channel measurement bandwidth (NOTE 2)	1.28 MHz	1.28 MHz	1.28 MHz	1.28MHz	1.28MHz	1.28MHz		

NOTE 1: Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum. NOTE 2: Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.

6.6.2.3.2A Minimum requirement UTRA for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the UTRA Adjacent Channel Leakage power Ratio (UTRA_{ACLR}) is the ratio of the filtered mean power centred on the assigned channel bandwidth on the component carrier to the filtered mean power centred on an adjacent channel frequency. The UTRA Adjacent Channel Leakage power Ratio is defined per carrier and the requirement is specified in subclause 6.6.2.3.2.

For intra-band contiguous carrier aggregation the UTRA Adjacent Channel Leakage power Ratio (UTRA_{ACLR}) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

For intra-band non-contiguous carrier aggregation when all sub-blocks consist of one component carrier the UTRA Adjacent Channel Leakage power Ratio (UTRA_{ACLR}) is the ratio of the sum of the filtered mean powers centered on the assigned sub-block frequencies to the filtered mean power centred on an adjacent(s) UTRA channel frequency. UTRA_{ACLR1/2} requirements are applicable for all sub-blocks and are specified in Table 6.6.2.3.2A-2. UTRA_{ACLR1} is required to be met in the sub-block gap when the gap bandwidth Wgap is 5MHz≤Wgap <15MHz. Both UTRA_{ACLR1} and UTRA_{ACLR2} are required to be met in the sub-block gap when the gap bandwidth Wgap is 15MHz≤Wgap.

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the UTRA Adjacent Channel Leakage power Ratio (UTRA_{ACLR}) is defined as follows. For the E-UTRA band supporting one component carrier, the UTRA Adjacent Channel Leakage power Ratio (UTRA_{ACLR}) is the ratio of the filtered mean power centred on the assigned channel bandwidth of the component carrier to the filtered mean power centred on an adjacent(s) UTRA channel frequency and the requirements specified in subclause 6.6.2.3.2 apply. For the E-UTRA band supporting two contiguous component carriers the UTRA Adjacent Channel Leakage power Ratio (UTRA_{ACLR}) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) UTRA channel frequency and the requirements specified in subclause 6.6.2.3.2A apply.

UTRA adjacent Channel Leakage power Ratio is specified for both the first UTRA adjacent channel (UTRA $_{ACLR1}$) and the 2^{nd} UTRA adjacent channel (UTRA $_{ACLR2}$). The UTRA channel power is measured with a RRC bandwidth filter with roll-off factor α =0.22. The assigned aggregated channel bandwidth power is measured with a rectangular filter with measurement bandwidth specified in Table 6.6.2.3.2A-1 for intraband contiguous carrier aggregation or 6.6.2.3.2A-2 for intraband non-contiguous carrier aggregation. If the measured UTRA channel power is greater than –50dBm then the UTRA $_{ACLR}$ shall be higher than the value specified in Table 6.6.2.3.2A-1 for intraband contiguous carrier aggregation or 6.6.2.3.2A-2 for intraband non-contiguous carrier aggregation.

Table 6.6.2.3.2A-1: Requirements for UTRA_{ACLR1/2}

	CA bandwidth class / UTRA _{ACLR1/2} / measurement bandwidth
	CA bandwidth class B and C
UTRA _{ACLR1}	33 dB
Adjacent channel centre frequency offset (in MHz)	+ BW _{Channel_CA} /2 + BW _{UTRA} /2 / - BW _{Channel_CA} / 2 - BW _{UTRA} /2
UTRA _{ACLR2}	36 dB
Adjacent channel centre frequency offset (in MHz)	+ BW _{Channel_CA} /2 + 3*BW _{UTRA} /2 / - BW _{Channel_CA} /2 - 3*BW _{UTRA} /2
CA E-UTRA channel Measurement bandwidth	BW _{Channel_CA} - 2* BW _{GB}
UTRA 5MHz channel Measurement bandwidth (NOTE 1)	3.84 MHz
UTRA 1.6MHz channel measurement bandwidth (NOTE 2)	1.28 MHz
	DD co-existence with UTRA FDD in paired spectrum. DD co-existence with UTRA TDD in unpaired spectrum.

Table 6.6.2.3.2A-2: Requirements for intraband non-contiguous CA UTRA_{ACLR1/2}

UTRA_{ACLR1/2} / measurement bandwidth UTRA_{ACLR1} 33 dB + $F_{edge,block,high}$ + $BW_{UTRA}/2$ Adjacent channel centre frequency offset (in MHz) - Fedge,block,low - BWutra/2 **UTRA**ACLR2 36 dB + F_{edge,block,high} + 3*BW_{UTRA}/2 Adjacent channel centre frequency offset (in MHz) - $F_{\text{edge,block,low}} - 3*BWutra/2$ Sub-block measurement BW_{Channel,block} - 2* BW_{GB} bandwidth UTRA 5 MHz channel Measurement bandwidth (NOTE 3.84 MHz 1) UTRA 1.6 MHz channel measurement bandwidth (NOTE 1.28 MHz Applicable for E-UTRA FDD co-existence with UTRA FDD in paired spectrum. Applicable for E-UTRA TDD co-existence with UTRA TDD in unpaired spectrum.

6.6.2.3.3A Minimum requirements for CA E-UTRA

For intra-band contiguous carrier aggregation the carrier aggregation E-UTRA Adjacent Channel Leakage power Ratio (CA E-UTRA_{ACLR}) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent aggregated channel bandwidth at nominal channel spacing. The assigned aggregated channel bandwidth power are measured with rectangular filters with

measurement bandwidths specified in Table 6.6.2.3.3A-1. If the measured adjacent channel power is greater than – 50dBm then the E-UTRA_{ACLR} shall be higher than the value specified in Table 6.6.2.3.3A-1.

	CA bandwidth class / CA E-UTRA _{ACLR} / Measurement bandwidth
	CA bandwidth class B and C
CA E-UTRA _{ACLR}	30 dB
CA E-UTRA channel Measurement bandwidth	BWchannel_CA - 2* BWGB
Adjacent channel centre frequency offset (in MHz)	+ BWChannel_CA / - BWChannel_CA

Table 6.6.2.3.3A-1: General requirements for CA E-UTRA_{ACLR}

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA_{ACLR}) is the ratio of the filtered mean power centred on the assigned channel bandwidth on a component carrier to the filtered mean power centred on an adjacent channel frequency. The E-UTRA Adjacent Channel Leakage power Ratio is defined per carrier and the requirement is specified in subclause 6.6.2.3.1.

For intra-band non-contiguous carrier aggregation when all sub-blocks consist of one component carrier the E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA_{ACLR}) is the ratio of the sum of the filtered mean powers centred on the assigned sub-block frequencies to the filtered mean power centred on an adjacent channel frequency at nominal channel spacing. In case the sub-block gap bandwidth Wgap is smaller than of the sub-block bandwidth then for that sub-block no E-UTRA_{ACLR} requirement is set for the gap. In case the sub-block gab bandwidth Wgap is smaller than either of the sub-block bandwidths then no E-UTRA_{ACLR} requirement is set for the gap. The assigned E-UTRA sub-block power and adjacent E-UTRA channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.6.2.3.3A-2. If the measured adjacent channel power is greater than –50dBm then the E-UTRA_{ACLR} shall be higher than the value specified in Table 6.6.2.3.3A-2.

Table 6.6.2.3.3A-2: General requirements for non-contiguous intraband CA E-UTRA_{ACLR}

	CC and adjacent channel bandwidth / E-UTRA _{ACLR} / Measurement bandwidth												
	1.4 MHz	1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz											
E-UTRA _{ACLR1}	30 dB	30 dB	30 dB	30 dB	30 dB	30 dB							
CC and adjacent channel measurement bandwidth [MHz]	1.08	2.7	4.5	9	13.5	18							
Adjacent channel centre frequency offset [MHz]	+ 1.4 / - 1.4	+ 3 / - 3	+ 5 / - 5	+ 10 / - 10	+ 15 / - 15	+ 20 / - 20							

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA_{ACLR}) is defined as follows. For the E-UTRA band supporting one component carrier, the E-UTRA Adjacent Channel Leakage power Ratio (UTRA_{ACLR}) is the ratio of the filtered mean power centred on the assigned channel bandwidth of the component carrier to the filtered mean power centred on an adjacent channel frequency and the requirements in subclause 6.6.2.3.1 apply. For the E-UTRA band supporting two contiguous component carriers the E-UTRA Adjacent Channel Leakage power Ratio (E-UTRA_{ACLR}) is the ratio of the filtered mean power centred on the aggregated channel bandwidth to the filtered mean power centred on an adjacent(s) aggregated channel bandwidth at nominal channel spacing and the requirements of CA E-UTRA_{ACLR} specified in subclause 6.6.2.3.3A apply.

6.6.2.4 Void

6.6.2.4.1 Void

6.6.2A Void

<reserved for future use>

6.6.2B Out of band emission for UL-MIMO

For UE supporting UL-MIMO, the requirements for Out of band emissions resulting from the modulation process and non-linearity in the transmitters are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.2 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.6.3 apply.

6.6.2C Void

<reserved for future use>

6.6.2D Out of band emission for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the requirements in subclause 6.6.2 apply.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the requirements in subclause 6.6.2 apply per E-UTRA ProSe sidelink and E-UTRA uplink transmission as specified for the corresponding inter-band aggregation with uplink assigned to two bands.

6.6.2F Out of band emission for category NB1

6.6.2F.1 Spectrum emission mask

The spectrum emission mask of the category NB1 UE applies to frequencies (Δf_{OOB}) starting from the \pm edge of the assigned category NB1 channel bandwidth. For frequencies greater than (Δf_{OOB}) as specified in Table 6.6.2F.1-1 the spurious requirements in subclause 6.6.3 are applicable.

The power of any category NB1 UE emission shall not exceed the levels specified in Table 6.6.2F.1-1. The spectrum emission limit between each Δf_{OOB} is linearly interpolated.

Table 6.6.2F.1-1: category NB1 UE spectrum emission mask

Δf _{OOB} (kHz)	Emission limit (dBm)	Measurement bandwidth
± 0	26	30 kHz
± 100	-5	30 kHz
± 150	-8	30 kHz
± 300	-29	30 kHz
± 500-1700	-35	30 kHz

In addition to the spectrum emission mask requirement in Table 6.6.2F.1-1 a category NB1 UE shall also meet the applicable E-UTRA spectrum emission mask requirement in sub-clause 6.6.2. E-UTRA spectrum emission requirement applies for frequencies that are Foffset away from edge of NB1 channel edge as defined in Table 6.6.2F.1-2.

Table 6.6.2F.1-2: Foffset for category NB1 UE spectrum emission mask

Channel BW (MHz)	Foffset [kHz]
1.4	165
3	190
5	200
10	225
15	240
20	245

Note: Foffset in Table 6.6.2F.1-2 is used to guarantee co-existence for guard-band operation.

6.6.2F.2 Void

<reserved for future use>

6.6.2F.3 Adjacent Channel Leakage Ratio for category NB1

Adjacent Channel Leakage power Ratio is the ratio of the filtered mean power centred on the assigned channel frequency to the filtered mean power centred on an adjacent channel frequency. The assigned category NB1 channel power and adjacent channel power are measured with filters and measurement bandwidths specified in Table 6.6.2F.3-1. If the measured adjacent channel power is greater than –50dBm then the category NB1 UE ACLR shall be higher than the value specified in Table 6.6.2F.3-1. GSM_{ACLR} requirement is intended for protection of GSM system. UTRA_{ACLR} requirement is intended for protection of UTRA and E-UTRA systems.

Table 6.6.2F.3-1: category NB1 UE ACLR requirements

	GSM _{ACLR}	UTRA
ACLR	20 dB	37 dB
Adjacent channel center frequency offset from category NB1 Channel edge	±200 kHz	±2.5 MHz
Adjacent channel measurement bandwidth	180 kHz 3.84 MI	
Measurement filter	Rectangular RRC-fi α=0.2	
Category NB1 channel measurement bandwidth	180 kHz	180 kHz
Category NB1 channel Measurement filter	Rectangular	Rectangular

6.6.3 Spurious emissions

Spurious emissions are emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products, but exclude out of band emissions unless otherwise stated. The spurious emission limits are specified in terms of general requirements inline with SM.329 [2] and E-UTRA operating band requirement to address UE co-existence.

To improve measurement accuracy, sensitivity and efficiency, the resolution bandwidth may be smaller than the measurement bandwidth. When the resolution bandwidth is smaller than the measurement bandwidth, the result should

be integrated over the measurement bandwidth in order to obtain the equivalent noise bandwidth of the measurement bandwidth.

6.6.3.1 Minimum requirements

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth. The spurious emission limits in Table 6.6.3.1-2 apply for all transmitter band configurations (NRB) and channel bandwidths.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.6.3.1-1: Boundary between E-UTRA out of band and spurious emission domain

Channel bandwidth	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz
OOB	2.8	6	10	15	20	25
boundary						
Foob (MHz)						

Table 6.6.3.1-2: Spurious emissions limits

$\begin{array}{cccccccccccccccccccccccccccccccccccc$		
$30 \text{ MHz} \le f < 1000 \text{ MHz}$ -36 dBm $1 \text{ GHz} \le f < 12.75 \text{ GHz}$ -30 dBm $12.75 \text{ GHz} \le f < 5^{\text{th}}$ harmonic of the upper	1 kHz	
1 GHz \leq f < 12.75 GHz -30 dBm 12.75 GHz \leq f < 5 th harmonic of the upper	10 kHz	
12.75 GHz ≤ f < 5 th harmonic of the upper	100 kHz	
harmonic of the upper	1 MHz	
UL operating band in GHz	1 MHz	1

6.6.3.1A Minimum requirements for CA

This clause specifies the spurious emission requirements for carrier aggregation.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the spurious emission requirement Table 6.6.3.1-2 apply for the frequency ranges that are more than F_{OOB} as defined in Table 6.6.3.1-1 away from edges of the assigned channel bandwidth on a component carrier. If for some frequency a spurious emission requirement of individual component carrier overlaps with the spectrum emission mask or channel bandwidth of another component carrier then it does not apply.

NOTE: For inter-band carrier aggregation with uplink assigned to two E-UTRA bands the requirements in Table 6.6.3.1-2 could be verified by measuring spurious emissions at the specific frequencies where second and third order intermodulation products generated by the two transmitted carriers can occur; in that case, the requirements for remaining applicable frequencies in Table 6.6.3.1-2 would be considered to be verified by the measurements verifying the one uplink inter-band CA spurious emission requirement.

For intra-band contiguous carrier aggregation the spurious emission limits apply for the frequency ranges that are more than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth (Table 5.6A-1). For frequencies Δ fOOB greater than FOOB as specified in Table 6.6.3.1A-1 the spurious emission requirements in Table 6.6.3.1-2 are applicable.

Table 6.6.3.1A-1: Boundary between E-UTRA out of band and spurious emission domain for intraband contiguous carrier aggregation

CA Bandwidth Class	OOB boundary F _{OOB} (МНz)
Α	Table 6.6.3.1-1
В	BW _{Channel_CA} + 5
С	BW _{Channel_CA} + 5

For intra-band non-contiguous carrier aggregation transmission the spurious emission requirement is defined as a composite spurious emission requirement. Composite spurious emission requirement applies to frequency ranges that are more than F_{OOB} away from the edges of the sub-blocks. Composite spurious emission requirement is defined as follows

- a) Composite spurious emission requirement is a combination of individual sub-block spurious emission requirements
- b) In case the sub-block consist of one component carrier the sub-lock spurious emission requirement and F_{OOB} are defined in subclause 6.6.3.1
- c) If for some frequency an individual sub-block spurious emission requirement overlaps with the general spectrum emission mask or the sub-block bandwidth of another sub-block then it does not apply

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band), the spurious emission requirememnt is defined as follows. For the E-UTRA band supporting one component carrier the requirements in Table 6.6.3.1-2 apply for frequency ranges that are more than FOOB (MHz) from the edges of assigned channel bandwidth as defined in Table 6.6.3.1-1. For the E-UTRA band supporting two contiguous component carriers the requirements in Table 6.6.3.1-2 apply for frequency ranges that are more than FOOB (MHz) from the edges of assigned aggregated channel bandwidth as defined in Table 6.6.3.1A-1. If for some frequency a spurious emission requirement of a single component carrier or two contiguous component carriers overlap with the spurious emission requirement or channel bandwidth of another component carrier or two contiguously aggregated carriers then it does not apply.

6.6.3.2 Spurious emission band UE co-existence

This clause specifies the requirements for the specified E-UTRA band, for coexistence with protected bands.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

Table 6.6.3.2-1: Requirements

	Spurious emission							
E-UTRA Band	Protected band	(MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE	
1	E-UTRA Band 1, 3, 5, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 44, 45, 65, 67, 68	F _{DL_low}	-	F_{DL_high}	-50	1		
	E-UTRA Band 34	F_{DL_low}	-	F_{DL_high}	-50	1	15	
	Frequency range	1880	-	1895	-40	1	15, 27	
	Frequency range	1895		1915	-15.5	5	15, 26, 27	
0	Frequency range	1915		1920	+1.6	5	15, 26, 27, 39	
2	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 26, 27, 28, 29, 30, 41, 42, 66	F _{DL_low}	-	F _{DL_high}	-50	1		
	E-UTRA Band 2, 25	F _{DL_low}	-	F _{DL_high}	-50	1	15	
3	E-UTRA Band 43 E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20,	F _{DL_low}	-	F _{DL_high}	-50	1	2	
	21, 26, 27, 28, 31, 32, 33, 34, 38, 39, 40, 41, 43, 44, 45, 65, 67, 68	F _{DL_low}	-	F _{DL_high}	-50	1		
	E-UTRA Band 3	F _{DL_low}	-	F _{DL_high}	-50	1	15	
	E-UTRA Band 22, 42	F_{DL_low}	-	F_{DL_high}	-50	1	2	
	Frequency range	1884.5	-	1915.7	-41	0.3		
4	E-UTRA Band 2, 4, 5, 7, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 30, 41, 43, 66	$F_{DL_{low}}$	-	F _{DL_high}	-50	1		
	E-UTRA Band 42	F_{DL_low}	-	F_{DL_high}	-50	1	2	
5	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14, 17, 23, 24, 25, 28, 29, 30, 31, 34, 38, 40, 42, 43, 45, 65, 66	F _{DL_low}	-	F _{DL_high}	-50	1		
	E-UTRA Band 26	859	-	869	-27	1		
	E-UTRA Band 41	F_{DL_low}	-	F _{DL_high}	-50	1	2	
	E-UTRA Band 18, 19	F _{DL low}	-	F _{DL high}	-40	1	38	
	E-UTRA Band 11, 21	F _{DL low}	-	F _{DL_high}	-50	1	38	
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 38	
6	E-UTRA Band 1, 9, 11, 34	F _{DL low}	-	F _{DL_high}	-50	1		
	Frequency range	860	-	875	-37	1		
	Frequency range	875	-	895	-50	1		
	. , ,	1884.5	-	1919.6	-41	0.3	7	
	Frequency range	1884.5	-	1915.7	-41	0.5	8	
7	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 12, 13, 14, 17, 20, 22, 26, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 65, 66, 67, 68	F _{DL_low}	-	F_{DL_high}	-50	1		
	Frequency range	2570	-	2575	+1.6	5	15, 21, 26	
	Frequency range	2575	-	2595	-15.5	5	15, 21, 26	
	Frequency range	2595	-	2620	-40	1	15, 21	
8	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 39, 40, 45, 65, 67, 68	F _{DL_low}	-	F _{DL_high}	-50	1		
	E-UTRA band 3, 7, 22, 41, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	2	
	E-UTRA Band 8	F _{DL_low}	-	F _{DL_high}	-50	1	15	
	E-UTRA Band 11, 21	F_{DL_low}	-	F _{DL_high}	-50	1	23	
	Frequency range	860	-	890	-40	1	15, 23	
	Frequency range	1884.5	-	1915.7	-41	0.3	8, 23	
9	E-UTRA Band 1, 3, 11, 18, 19, 21, 26, 28, 34	F _{DL_low}	-	F _{DL_high}	-50	1		
	E-UTRA Band 42	F _{DL_low}	-	F _{DL_high}	-50	1	2	
	Frequency range	945	-	960	-50	1	ļ	
	Frequency range	1884.5	-	1915.7	-41	0.3	8	
	Frequency range	2545	-	2575	-50	1		
	Frequency range	2595	-	2645	-50	1		

10	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17,	_		_	50		
	23, 24, 25, 26, 27, 28, 29, 30, 41, 43, 66	$F_{DL_{low}}$	-	F _{DL_high}	-50	1	
	E-UTRA Band 22, 42	F_{DL_low}	-	F_{DL_high}	-50	1	2
11	E-UTRA Band 1, 3, 11, 18, 19, 21, 28, 34, 42, 65	$F_{DL_{low}}$	1	F_{DL_high}	-50	1	
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	
12	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25, 26, 27, 30, 41	$F_{DL_{low}}$	-	F_{DL_high}	-50	1	
	E-UTRA Band 4, 10, 66	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 12	F_{DL_low}	-	F_{DL_high}	-50	1	15
13	E-UTRA Band 2, 4, 5, 10, 12, 13, 17, 23, 25, 26, 27, 29, 41, 66	F_{DL_low}	1	F_{DL_high}	-50	1	
	E-UTRA Band 14	F_{DL_low}	-	F_{DL_high}	-50	1	15
	E-UTRA Band 24, 30	F_{DL_low}	-	F _{DL_high}	-50	1	2
	Frequency range	769	-	775	-35	0.00625	15
	Frequency range	799	-	805	-35	0.00625	11, 15
14	E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 29, 30, 41, 66	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	769	-	775	-35	0.00625	12, 15
	Frequency range	799	-	805	-35	0.00625	11, 12, 15
17	E-UTRA Band 2, 5, 13, 14, 17, 23, 24, 25, 26, 27, 30, 41	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 4, 10, 66	F_{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 12	F _{DL_low}	-	F _{DL_high}	-50	1	15
18	E-UTRA Band 1, 3, 11, 21, 34, 42, 65	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	758	-	799	-50	1	
	Frequency range	799	-	803	-40	1	15
	Frequency range	860	-	890	-40	1	
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	
19	E-UTRA Band 1, 3, 11, 21, 28, 34, 42, 65	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	-	2645	-50	1	

Section	1 1 1 1 1 1 0.3 1 1 1 1 1 1 1 1 1 1 1 1 1 1	15 2 8 8
E-UTRA Band 20 E-UTRA Band 38, 42 FDL_low - FDL_high -50 Frequency range 758 - 788 -50 21 E-UTRA Band 1, 3, 18, 19, 28, 34, 42, 65 Frequency range 945 - 960 -50 Frequency range 1884.5 - 1915.7 -41 Frequency range 2545 - 2575 -50 Frequency range 2595 - 2645 -50 Frequency range 2595 - 2645 -50 22 E-UTRA Band 1, 3, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 38, 39, 40, 43, 65, 67, 68 Frequency range 3525 - 3590 -50 23 E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 26, 27, 29, 30, 41, 66 E-UTRA Band 2 E-UTRA Band 2 F-UTRA Band 4 FDL_low - FDL_high -50 24 E-UTRA Band 2 F-UTRA Band 2 F-UTRA Band 4 FDL_low - FDL_high -50 25 E-UTRA Band 4 FDL_low - FDL_high -50 26 E-UTRA Band 4 FDL_low - FDL_high -50	1 1 1 0.3 1 1 1 1 1 1 1	8
E-UTRA Band 38, 42 Frequency range 21 E-UTRA Band 1, 3, 18, 19, 28, 34, 42, 65 Frequency range 21 Frequency range 22 Frequency range 345 Frequency range 4884.5 Frequency range 4884.5 Frequency range 2545 Frequency range 2545 Frequency range 2545 Frequency range 2545 Frequency range 31, 32, 33, 34, 38, 39, 40, 43, 65, 67, 68 Frequency range 3510 Frequency range 3525 Frequency range 550 Frequen	1 1 1 0.3 1 1 1 1 1 1 1	8
Frequency range	1 1 0.3 1 1 1 1 1 1 1	8
E-UTRA Band 1, 3, 18, 19, 28, 34, 42, 65	1 0.3 1 1 1 1 1 1 1	
Frequency range 945 - 960 -50 Frequency range 1884.5 - 1915.7 -41 Frequency range 2545 - 2575 -50 Frequency range 2595 - 2645 -50 E-UTRA Band 1, 3, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 38, 39, 40, 43, 65, 67, 68 Frequency range 3510 - 3525 -40 Frequency range 3525 - 3590 -50 23 E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 26, 27, 29, 30, 41, 66 E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, 30, 41, 42, 66 E-UTRA Band 43 FDL_low - FDL_high -50 26 E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 65, 66 E-UTRA Band 41 FDL_low - FDL_high -50 E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 65, 66 E-UTRA Band 41 FDL_low - FDL_high -50	1 0.3 1 1 1 1 1 1 1 1	
Frequency range	0.3 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Frequency range	1 1 1 1 1 1 1 1	
22	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	15
31, 32, 33, 34, 38, 39, 40, 43, 65, 67, 68 Frequency range Frequency range 3510 - 3525 - 40 Frequency range 3525 - 3590 - 50 23 E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 26, 27, 29, 30, 41, 66 24 E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, 30, 41, 66 25 E-UTRA Band 4, 5, 10,12, 13, 14, 17, 23, 24, 26, 27, 28, 29, 30, 41, 42, 66 E-UTRA Band 2 E-UTRA Band 3 E-UTRA Band 43 FDL_low FDL_low FDL_low FDL_high FDL_high FDL_high FDL_low FDL_high FDL_hi	1 1 1 1 1	15
State	1 1 1 1 1	15
Frequency range 23	1 1 1 1 1	15
23	1 1 1 1	
23, 24, 26, 27, 29, 30, 41, 66 24 E-UTRA Band 2, 4, 5, 10, 12, 13, 14, 17, 23, 24, 25, 26, 29, 30, 41, 66 25 E-UTRA Band 4, 5, 10,12, 13, 14, 17, 23, 24, 26, 27, 28, 29, 30, 41, 42, 66 E-UTRA Band 2 E-UTRA Band 43 FDL_low FDL_low FDL_high FDL_high FDL_low FDL_high	1 1 1	
24	1	
23, 24, 25, 26, 29, 30, 41, 66 25 E-UTRA Band 4, 5, 10,12, 13, 14, 17, 23, 24, 26, 27, 28, 29, 30, 41, 42, 66 E-UTRA Band 2 E-UTRA Band 43 FDL_low FDL_low FDL_high -50 E-UTRA Band 43 FDL_low FDL_low FDL_high -50 26 E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 65, 66 E-UTRA Band 41 FDL_low FDL_low FDL_high -50	1	
24, 26, 27, 28, 29, 30, 41, 42, 66 E-UTRA Band 2 E-UTRA Band 43 FDL_low FDL_low FDL_high -50 E-UTRA Band 43 FDL_low FDL_low FDL_high -50 26 E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 65, 66 E-UTRA Band 41 FDL_low FDL_low FDL_high -50	1	
24, 26, 27, 28, 29, 30, 41, 42, 66 E-UTRA Band 2 E-UTRA Band 43 FDL_low - FDL_high -50 26 E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 21, 23, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 65, 66 E-UTRA Band 41 FDL_low - FDL_high -50	1	
E-UTRA Band 43 F _{DL_low} - F _{DL_high} -50 26 E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18,19, 21, 23, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 65, 66 E-UTRA Band 41 F _{DL_low} - F _{DL_high} -50		45
26 E-UTRA Band 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18,19, 21, 23, 24, 25, 26, 29, 30, 31, 34, 39, 40, 42, 43, 65, 66 E-UTRA Band 41 F _{DL_low} - F _{DL_high} -50	1	15 2
13, 14, 17, 18,19, 21, 23, 24, 25, 26, 29,	1	
E-UTRA Band 41 F _{DL_low} - F _{DL_high} -50	1	
	1	2
Frequency range 703 - 799 -50	1	
Frequency range 799 - 803 -40	1	15
Frequency range 945 - 960 -50	1	
Frequency range 1884.5 - 1915.7 -41	0.3	8
27 E-UTRA Band 1, 2, 3, 4, 5, 7, 10, 12, 13, 14, 17, 23, 25, 26, 27, 29, 30, 31, 38, 40, F _{DL_low} - F _{DL_high} -50	1	
41, 42, 43, 65, 66 E-UTRA Band 28 F _{DL low} - 790 -50	1	
35_100		
Frequency range 799 - 805 -35 28 E-UTRA Band 1, 4, 10, 22, 32, 42, 43,	0.00625	
65, 66 F _{DL_low} - F _{DL_high} -50	1	2
E-UTRA Band 1 F _{DL_low} - F _{DL_high} -50	1	19, 25
E-UTRA Band 2, 3, 5, 7, 8, 18, 19, 20, F _{DL low} - F _{DL ligh} -50	1	
25, 26, 27, 31, 34, 38, 40, 41		
E-UTRA Band 11, 21	1	19, 24
Frequency range 470 - 694 -42	8	15, 35
Frequency range 470 - 710 -26.2	6	34
Frequency range 662 - 694 -26.2	6	15
Frequency range 758 - 773 -32	1	15
Frequency range 773 - 803 -50	1	
Frequency range 1884.5 - 1915.7 -41 30 E-UTRA Band 2, 4, 5, 7, 10, 12, 13, 14,	0.3	8, 19
30 E-UTRA Band 2, 4, 5, 7, 10, 12, 13, 14,	1	
31 E-UTRA Band 1, 5, 7, 8, 20, 22, 26, 27, 28, 31, 32, 33, 34, 38, 40, 42, 43, 65, 67, F _{DL_low} - F _{DL_high} -50	1	
68 E-UTRA Band 3 F _{DL low} - F _{DL high} -50	1	2
		2
	8	
33 E-UTRA Band 1, 7, 8, 20, 22, 28, 31, 32,	_	
34, 38, 40, 42, 43, 65, 67	1	5
E-UTRA Band 3 F _{DL_low} - F _{DL_high} -50	1	15
34 E-UTRA Band 1, 3, 7, 8, 11, 18, 19, 20, 21, 22, 26, 28, 31, 32, 33, 38,39, 40, 41, 42, 43, 44, 45, 65, 67 - F _{DL_low} - F _{DL_high} -50	1	5
Frequency range 1884.5 - 1915.7 -41	0.3	8
35		
36	1	
³⁰		
36	1	•

	14, 17, 20, 22, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 65, 66, 67, 68						
	Frequency range	2620	-	2645	-15.5	5	15, 22, 26
	Frequency range	2645	-	2690	-40	1	15, 22
39	E-UTRA Band 1, 8, 22, 26, 34, 40, 41, 42, 44, 45	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	1805		1855	-40	1	33
	Frequency range	1855		1880	-15.5	5	15,26,33
40	E-UTRA Band 1, 3, 5, 7, 8, 20, 22, 26, 27, 28, 31, 32, 33, 34, 38, 39, 41, 42, 43, 44, 45, 65, 67, 68	F _{DL_low}	-	$F_{DL_{high}}$	-50	1	
41	E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 30, 34, 39, 40, 42, 44, 45, 65, 66	F _{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 9, 11, 18, 19, 21	F_{DL_low}	-	F_{DL_high}	-50	1	30
	Frequency range	1884.5		1915.7	-41	0.3	8, 30
42	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 11, 18, 19, 20, 21, 25, 26, 27, 28, 31, 32, 33, 34, 38, 40, 41, 44, 45, 65, 66, 67, 68	F _{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	8
43	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 20, 25, 26, 27, 28, 31,32, 33, 34, 38, 40, 65, 66, 67, 68	F_{DL_low}	-	F _{DL_high}	-50	1	
44	E-UTRA Band 1, 40, 42, 45	F _{DL low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 3, 5, 8, 34, 39, 41	F_{DL_low}	-	F _{DL_high}	-50	1	
45	E-UTRA Band 1, 3, 5, 8, 34, 39, 40, 41, 42.44	F _{DL_low}	-	F _{DL_high}	-50	1	
65	E-UTRA Band 1, 3, 7, 8, 20, 22, 28, 31, 32, 38, 40, 42, 43, 65, 68	F_{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 5, 11, 18, 19, 21, 26, 27, 41	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 34	F_{DL_low}	-	F_{DL_high}	-50	1	36
	Frequency range	1884.5	-	1915.7	-41	0.3	37
	Frequency range	1900	-	1915	-15.5	5	15, 26, 27
	Frequency range	1915	-	1920	+1.6	5	15, 26, 27
66	E-UTRA Band 2, 4, 5, 7, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 30, 38, 41, 43, 66	F _{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 42	F_{DL_low}		F _{DL_high}	-50	1	2
68	E-UTRA Band 3, 7, 8, 20, 22, 28, 31, 38, 40, 42, 43, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 1	F_{DL_low}	-	F _{DL_high}	-50	1	2
	· · · · · · · · · · · · · · · · · · ·						

NOTE 1: FDL_low and FDL_high refer to each E-UTRA frequency band specified in Table 5.5-1

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd, 4th [or 5th] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x L_{CRB} x 180kHz), where N is 2, 3, 4, [5] for the 2nd, 3rd, 4th [or 5th] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.

NOTE 3: N/A

NOTE 4: N/A

NOTE 5: For non synchronised TDD operation to meet these requirements some restriction will be needed for either the operating band or protected band

NOTE 6: N/A

NOTE 7: Applicable when co-existence with PHS system operating in 1884.5-1919.6MHz.

NOTE 8: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz.

NOTE 9: N/A

NOTE 10: N/A

NOTE 11: Whether the applicable frequency range should be 793-805MHz instead of 799-805MHz is TBD

NOTE 12: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB

NOTE 13: N/A

NOTE 14: N/A

NOTE 15: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 16: N/A

NOTE 17: N/A

- NOTE 18: N/A
- NOTE 19: Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
- NOTE 20: N/A
- NOTE 21: This requirement is applicable for any channel bandwidths within the range 2500 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE 22: This requirement is applicable for any channel bandwidths within the range 2570 2615 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2605.5 2607.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2597 2605 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.

 For carriers with channel bandwidth overlapping the frequency range 2615 2620 MHz the requirement applies with the maximum output power configured to +19 dBm in the IE *P-Max*.
- NOTE 23: This requirement is applicable only for the following cases:

 for carriers of 5 MHz channel bandwidth when carrier centre frequency (F_c) is within the range 902.5 MHz $\leq F_c < 907.5$ MHz with an uplink transmission bandwidth less than or equal to 20 RB for carriers of 5 MHz channel bandwidth when carrier centre frequency (F_c) is within the range 907.5 MHz $\leq F_c \leq 912.5$ MHz without any restriction on uplink transmission bandwidth.

 for carriers of 10 MHz channel bandwidth when carrier centre frequency (F_c) is $F_c = 910$ MHz with an uplink transmission bandwidth less than or equal to 32 RB with RB_{start} > 3.
- NOTE 24: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW).
- NOTE 25: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW).
- NOTE 26: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
- NOTE 27: This requirement is applicable for any channel bandwidths within the range 1920 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE 28: N/A
- NOTE 29: N/A
- NOTE 30: This requirement applies when the E-UTRA carrier is confined within 2545-2575MHz or 2595-2645MHz and the channel bandwidth is 10 or 20 MHz
- NOTE 31: N/A
- NOTE 32: Void
- NOTE 33: This requirement is only applicable for carriers with bandwidth confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 1892.5 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 1895 1903 MHz.
- NOTE 34: This requirement is applicable for 5 and 10 MHz E-UTRA channel bandwidth allocated within 718-728MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and RBstart < 48.
- NOTE 35: This requirement is applicable in the case of a 10 MHz E-UTRA carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.
- NOTE 36: This requirement is applicable for E-UTRA channel bandwidth allocated within 1920-1980 MHz.
- NOTE 37: Applicable when the upper edge of the channel bandwidth frequency is greater than 1980MHz.
- NOTE 38: Applicable only for UE category M1 and NB1.
- NOTE 39: For category NB1 UE when carrier centre frequency is 1920.1 MHz, in case of single-tone uplink transmission the requirement is applicable only for sub-carrier index > 2.

NOTE: The restriction on the maximum uplink transmission to 54 RB in Notes 21, 22, and 27 of Table 6.6.3.2-1 and the restriction on the single-tone uplink transmission to sub-carrier index > 2 in Note 39 of Table 6.6.3.2-1 are intended for conformance testing and may be applied to network operation to facilitate coexistence when the aggressor and victim bands are deployed in the same geographical area. The applicable spurious emission requirement of -15.5 dBm/5MHz is a least restrictive technical condition for FDD/TDD coexistence and may have to be revised in the future.

6.6.3.2A Spurious emission band UE co-existence for CA

This clause specifies the requirements for the specified carrier aggregation configurations for coexistence with protected bands.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

For inter-band carrier aggregation with the uplink assigned to two E-UTRA bands, the requirements in Table 6.6.3.2A-0 apply on each component carrier with all component carriers are active.

NOTE: For inter-band carrier aggregation with uplink assigned to two E-UTRA bands the requirements in Table 6.6.3.2A-0 could be verified by measuring spurious emissions at the specific frequencies where second and third order intermodulation products generated by the two transmitted carriers can occur; in that case, the requirements for remaining applicable frequencies in Table 6.6.3.2A-0 would be considered to be verified by the measurements verifying the one uplink inter-band CA UE to UE co-existence requirements.

Table 6.6.3.2A-0: Requirements for uplink inter-band carrier aggregation (two bands)

	Spurious emission							
E-UTRA CA Protected band Configuration			Frequency range (MHz)		Maximum Level (dBm)	MBW (MHz)	NOTE	
CA_1A-3A	E-UTRA Band 1, 5, 7, 8, 11, 18, 19, 20, 21, 26, 27, 28, 31, 32, 38, 40, 41, 43, 44, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1		
	E-UTRA band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	3	
	E-UTRA band 22, 42	F_{DL_low}	-	F _{DL_high}	-50	1	2	
	Frequency range	1884.5	-	1915.7	-41	0.3	7	
	Frequency range	1880		1895	-40	1	3,12	
	Frequency range	1895		1915	-15.5	5	3, 12, 13	
	Frequency range	1915		1920	+1.6	5	3, 12, 13	
CA_1A-5A	E-UTRA Band 1, 5, 7, 8, 22, 28, 31, 38, 40, 42, 43, 65	F_{DL_low}	-	F _{DL_high}	-50	1		
	E-UTRA band 3,34	F_{DL_low}	-	F_{DL_high}	-50	1	3	
	E-UTRA band 26	859	-	869	-27	1		
	E-UTRA band 41	$F_{DL_{low}}$	-	F_{DL_high}	-50	1	2	
CA_1A-7A	E-UTRA Band 1, 5, 7, 8, 20, 22, 26, 27, 28, 31,32, 40, 42, 43, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1		
	E-UTRA band 3, 34	$F_{DL_{low}}$	-	F_{DL_high}	-50	1	3	
	Frequency range	1880		1895	-40	1	3,12	
	Frequency range	1895		1915	-15.5	5	3, 12, 13	
	Frequency range	1915		1920	+1.6	5	3, 12, 13	
	Frequency range	2570	-	2575	+1.6	5	3, 13, 14	
	Frequency range	2575	-	2595	-15.5	5	3, 13, 14	
	Frequency range	2595	-	2620	-40	1	3, 14	
CA_1A-8A	E-UTRA Band 1, 20, 28, 31, 32, 38, 40, 65, 67	F_{DL_low}	-	F _{DL_high}	-50	1		
	E-UTRA band 3	$F_{DL_{low}}$	-	F_{DL_high}	-50	1	2,3	
	E-UTRA band 7, 22, 41, 42, 43	F_{DL_low}	-	F_{DL_high}	-50	1	2	
	E-UTRA Band 8, 34	F_{DL_low}	-	F_{DL_high}	-50	1	3	
	E-UTRA band 11, 21	F_{DL_low}	-	F_{DL_high}	-50	1	11	
	Frequency range	860	-	890	-40	1	3, 11	
	Frequency range	1884.5	-	1915.7	-41	0.3	7, 11	
	Frequency range	1880		1895	-40	1	3,12	
	Frequency range	1895		1915	-15.5	5	3, 12, 13	
	Frequency range	1915		1920	+1.6	5	3, 12, 13	
CA_1A-18A	E-UTRA Band 1, 3, 11, 21, 42, 65	F_{DL_low}	-	F_{DL_high}	-50	1		
	E-UTRA Band 34	F _{DL_low}	-	F_{DL_high}	-50	1	3	
	Frequency range	758	-	799	-50	1		
	Frequency range	799	-	803	-40	1	3	
	Frequency range	860	-	890	-40	1		
	Frequency range	945	-	960	-50	1		
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 7	
	Frequency range	2545	-	2575	-50	1		
04 14 15 1	Frequency range	2595	-	2645	-50	1		
CA_1A-19A	E-UTRA Band 1, 3, 11, 21, 28, 42, 65	F _{DL_low}	-	F _{DL_high}	-50	1		
	E-UTRA Band 34	F _{DL_low}	-	F _{DL_high}	-50	1	3	
	Frequency range	860	<u> </u>	890	-40	1	3, 8	
	Frequency range	945	<u> </u>	960	-50	1		
	Frequency range	1884.5	-	1915.7	-41	0.3	3, 7	
	Frequency range	2545	<u> </u> -	2575	-50	1		
04 14 - : :	Frequency range	2595	-	2645	-50	1		
CA_1A-21A	E-UTRA Band 11	F_{DL_low}	-	F _{DL_high}	-35	1	3, 16	
	E-UTRA Band 1, 3, 18, 19, 28, 34, 42, 65	F _{DL_low}	-	F _{DL_high}	-50	1		
	E-UTRA Band 21	F_{DL_low}	ļ -	F_{DL_high}	-50	1	16	
	Frequency range	1884.5	-	1915.7	-41	0.3	7	

	Frequency range	945	₋	960	-50	1	
	Frequency range	2545	_	2575	-50	1	
	Frequency range	2595	_	2645	-50	1	
CA_1A-26A	E-UTRA Band 1, 3, 5, 7, 11, 18, 19, 20, 21, 22, 26, 27, 31, 38, 40,				-50	1	
	42, 43, 44, 65	F _{DL_low}	-	F _{DL_high}	40	4	2.40
	Frequency range	1880	-	1895	-40	1	3, 12
	Frequency range	1895	-	1915	-15.5	5	3, 12, 13
	Frequency range	1915	-	1920	+1.6	5	3, 12, 13
	Frequency range	1884.5	-	1915.7	-41	0.3	7
	Frequency range	945	-	960	-50	1	_
	E-UTRA Band 41	F_{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 34	F_{DL_low}	-	F_{DL_high}	-50	1	3
	Frequency range	703	-	799	-50	1	
04 44 004	F. I. T. D. D. 10 5 7 0 40 40	799	-	803	-40	1	3
CA_1A-28A	E-UTRA Band 3, 5, 7, 8, 18, 19, 20, 26, 27, 31, 32, 38, 40, 41	F _{DL_low}	-	F _{DL_high}	-50 -50	1	2
	E-UTRA Band 22, 42, 43	F _{DL_low}	-	F _{DL_high}			
	E-UTRA Band 34	F _{DL_low}	-	F _{DL_high}	-50 -50	1	3
	E-UTRA Band 11, 21	F _{DL_low}	-	F _{DL_high}			5, 21
	E-UTRA Band 1, 65	F_{DL_low}	-	F _{DL_high}	-50	1	5, 6
	Frequency range	470	-	694	-42	8	3, 22
	Frequency range	470	-	710	-26.2	6	23
	Frequency range	758	-	773	-32	1	3
	Frequency range	773	-	803	-50	1	
	Frequency range	662	-	694	-26.2	6	3
	Frequency range	1880		1895	-40	1	3,12
	Frequency range	1895		1915	-15.5	5	3, 12, 13
	Frequency range	1915		1920	+1.6	5	3, 12, 13
CA_1A-42A	Frequency range E-UTRA Band 1, 3, 5, 7, 8, 11,	1884.5	-	1915.7	-41	0.3	5, 7
	18, 19, 20, 21, 26, 27, 28, 31, 32,	□		E	-50	1	
	38, 40, 41, 44, 65, 67 E-UTRA Band 34	F _{DL_low}	-	F _{DL_high}	-50	1	3
	Frequency range	F _{DL_low} 1880	-	F _{DL_high} 1895	-40	1	3,12
					-15.5	5	3, 12, 13
	Frequency range	1895		1915 1920	+1.6	5	3, 12, 13
	Frequency range	1915 1884.5		1920	-41	0.3	3, 72, 13
CA_2A-4A	Frequency range E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 22, 23, 24, 26, 27, 28, 29, 30, 41, 66	F _{DL_low}	_	F _{DL_high}	-50	1	3, 7
	E-UTRA Band 2, 25	F _{DL_low}	-	F _{DL high}	-50	1	3
	E-UTRA Band 42, 43	F _{DL low}	-	F _{DL high}	-50	1	2
CA_2A-5A	E-UTRA Band 4, 5, 10, 12, 13, 14, 17, 23, 24, 28, 29, 30, 42, 66	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 2, 25	F_{DL_low}	-	F _{DL_high}	-50	1	3
	E-UTRA Band 26	859	-	869	-27	1	
	E-UTRA Band 41, 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
CA_2A-12A	E-UTRA Band 5, 13, 14, 17, 23, 24, 26, 27, 30, 41	F_{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 2, 12, 25	F_{DL_low}	-	F_{DL_high}	-50	1	3
	E-UTRA Band 4, 10 , 66	F_{DL_low}	-	F _{DL_high}	-50	1	2
CA_2A-13A	E-UTRA Band 4, 5,10,12,13,17, 22, 23, 26, 27, 29, 41, 42, 66	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA Band 2,14, 25	F_{DL_low}	-	F_{DL_high}	-50	1	3
	E-UTRA Band 24, 30, 43	F _{DL_low}	-	F _{DL_high}	-50	1	2
	Frequency range	769	-	775	-35	0.00625	3
	Frequency range	799	-	805	-35	0.00625	3, 9
CA_3A-5A	E-UTRA Band 1, 5, 7, 8, 22, 28, 31, 38, 40, 42, 43, 65	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA band 3,34	$F_{DL_{low}}$	-	F _{DL_high}	-50	1	3
04 54 = :	E-UTRA band 26	859	-	869	-27	1	
CA_3A-7A	E-UTRA Band 1, 5, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 40, 43, 44, 65, 67	F_{DL_low}	-	F _{DL_high}	-50	1	

E FI FI CA_3A-8A E E E E FI FI CA_3A-19A E E	E-UTRA band 3 E-UTRA band 22, 42 Frequency range Frequency range Frequency range Frequency range F-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 39, 40, 44, 65, 67 E-UTRA band 3, 8 E-UTRA band 11, 21 E-UTRA band 7, 22, 41, 42, 43 Frequency range Frequency range Frequency range F-UTRA Band 1, 11, 21, 28, 65 E-UTRA Band 34	FDL_low FDL_low 2570 2575 2595 FDL_low FDL_low FDL_low FDL_low FDL_low 1884.5		F _{DL_high} F _{DL_high} 2575 2595 2620 F _{DL_high} F _{DL_high}	-50 -50 +1.6 -15.5 -40 -50	1 1 5 5	3 2 3, 13, 14 3, 13, 14 3, 14
CA_3A-8A	requency range requency range requency range -UTRA Band 1, 20, 28, 31, 32, 3, 34, 38, 39, 40, 44, 65, 67 -UTRA band 3, 8 -UTRA band 11, 21 -UTRA band 7, 22, 41, 42, 43 requency range requency range -UTRA Band 1, 11, 21, 28, 65	2570 2575 2595 F _{DL_low} F _{DL_low} F _{DL_low} 1884.5		2575 2595 2620 F _{DL_high}	-15.5 -40	5	3, 13, 14
CA_3A-8A	requency range -UTRA Band 1, 20, 28, 31, 32, 3, 34, 38, 39, 40, 44, 65, 67 -UTRA band 3, 8 -UTRA band 11, 21 -UTRA band 7, 22, 41, 42, 43 requency range requency range -UTRA Band 1, 11, 21, 28, 65	2575 2595 FDL_low FDL_low FDL_low FDL_low 4884.5	-	2595 2620 F _{DL_high}	-15.5 -40	5	3, 13, 14
CA_3A-8A	requency range E-UTRA Band 1, 20, 28, 31, 32, 3, 34, 38, 39, 40, 44, 65, 67 E-UTRA band 3, 8 E-UTRA band 11, 21 E-UTRA band 7, 22, 41, 42, 43 Frequency range Frequency range F-UTRA Band 1, 11, 21, 28, 65	2595 F _{DL_low} F _{DL_low} F _{DL_low} F _{DL_low} 1884.5	-	2620 F _{DL_high}		1	
CA_3A-8A	E-UTRA Band 1, 20, 28, 31, 32, 3, 34, 38, 39, 40, 44, 65, 67 E-UTRA band 3, 8 E-UTRA band 11, 21 E-UTRA band 7, 22, 41, 42, 43 Frequency range Frequency range E-UTRA Band 1, 11, 21, 28, 65	F _{DL_low} F _{DL_low} F _{DL_low} F _{DL_low} 1884.5	-	- 0	-50		
E E E FI FI CA_3A-19A E E	E-UTRA band 3, 8 E-UTRA band 11, 21 E-UTRA band 7, 22, 41, 42, 43 Frequency range Frequency range E-UTRA Band 1, 11, 21, 28, 65	F _{DL_low} F _{DL_low} F _{DL_low} 1884.5	-	- 0		1 1	
E E F F C C A_3A-19A E E	-UTRA band 11, 21 -UTRA band 7, 22, 41, 42, 43 requency range requency range -UTRA Band 1, 11, 21, 28, 65	F _{DL_low} F _{DL_low} 1884.5 860	-		-50	1	2, 3
E Fi Fi CA_3A-19A E E	-UTRA band 7, 22, 41, 42, 43 requency range requency range -UTRA Band 1, 11, 21, 28, 65	F _{DL_low} 1884.5 860	-	F _{DL_high}	-50	1	11
CA_3A-19A E	requency range requency range -UTRA Band 1, 11, 21, 28, 65	1884.5 860		F _{DL_high}	-50	1	2
CA_3A-19A <u>E</u>	requency range -UTRA Band 1, 11, 21, 28, 65	860		1915.7	-30 -41	0.3	4, 11
CA_3A-19A <u>E</u>	-UTRA Band 1, 11, 21, 28, 65			890	-40	1	3,11,17
E.		F_{DL_low}	_	F _{DL_high}	-50	1	3,11,17
	. OTTO C Daria OT	F _{DL low}	-	F _{DL_high}	-50	1	3
	-UTRA Band 42	F _{DL_low}	_	F _{DL_high}	-50	1	2
	requency range	860	-	890	-40	1	3, 8
	requency range	945	_	960	-50	1	0, 0
	requency range	1884.5	_	1915.7	-41	0.3	3, 4
	requency range	2545	-	2575	-50	1	0, 1
	requency range	2595	_	2645	-50	1	
	E-UTRA Band 1, 7, 8, 31, 32, 33,			_			
	4, 40, 43, 65, 67	F _{DL_low}	-	F _{DL_high}	-50	1	
E	-UTRA Band 3, 20	F_{DL_low}	-	F_{DL_high}	-50	1	3
E-	-UTRA Band 22, 38, 42	F_{DL_low}	-	F_{DL_high}	-50	1	2
	requency range	758	-	788	-50	1	
	E-UTRA Band 1, 5, 7, 11, 18, 19, 1, 26, 34, 39, 40, 43, 65	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA band 3	F _{DL_low}	_	F _{DL high}	-50	1	3
<u> </u>	-OTTA balla 3	I DL_IOW		I DL_nign	- 00		-
l E	E-UTRA band 22, 41, 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
l ——	requency range	1884.5	-	1915.7	-41	0.3	4, 10
	. , ,	703	_	799	-50	1	.,
F	requency range	799	_	803	-40	1	3
F	requency range	851	_	859	-53	0.00625	15
	requency range	945	_	960	-50	1	
CA_4A-5A E	E-UTRA Band 2, 4, 5, 7, 10, 12, 3, 14, 17, 23, 24, 25, 28, 29, 30, 3 , 66	$F_{DL_{low}}$	-	F_{DL_high}	-50	1	
E-	-UTRA Band 26	859	•	869	-27	1	
E	-UTRA band 41, 42	F_{DL_low}		F_{DL_high}	-50	1	2
	-UTRA Band 2, 4, 5, 7, 10, 12, 3, 14, 17, 26, 27, 28, 29, 30, 43, 6	F_{DL_low}	-	F_{DL_high}	-50	1	
<u>E</u>	-UTRA band 42	F_{DL_low}	-	F_{DL_high}	-50	1	2
Fi	requency range	2570	-	2575	+1.6	5	3, 13, 14
F	requency range	2575	-	2595	-15.5	5	3, 13, 14
	requency range	2595	-	2620	-40	1	3, 14
	E-UTRA Band 2, 5, 7,13, 14, 17, 2, 23, 24, 25, 26, 27, 30, 41, 43	F_{DL_low}	-	F_{DL_high}	-50	1	
E-	-UTRA Band 4, 10. 42, 66	F_{DL_low}	-	F_{DL_high}	-50	1	2
	-UTRA Band 12	F_{DL_low}		F_{DL_high}	-50	1	3
_ 10	E-UTRA Band 2,4, 5, 7, 0,12,13,17, 22, 23,25, 26, 27, 9, 41, 43, 66	F_{DL_low}	1	F_{DL_high}	-50	1	
	-UTRA Band 14	F _{DL_low}	-	F _{DL_high}	-50	1	3
	-UTRA Band 24, 30, 42	F _{DL_low}	-	F _{DL_high}	-50	1	2
Fi	requency range	769	-	775	-35	0.00625	3
F	requency range	799	_	805	-35	0.00625	3, 9
	-UTRA Band 2, 5, 7,13, 14, 17,	F _{DL_low}	-	F_{DL_high}	-50	1	
	2, 23, 24, 25, 26, 27, 30, 41, 43 E-UTRA Band 4, 10. 42, 66	F _{DL_low}		F _{DL high}	-50	1	2
	E-UTRA Band 12	F _{DL_low}		F _{DL_high}	-50 -50	1	3
CA_5A-7A E-	-UTRA Band 1, 2, 3, 4, 5, 7, 8, 0, 12, 13, 14, 17, 22, 28, 29, 30, 1, 40, 42, 43, 65, 66	F _{DL_low}	-	F _{DL_high}	-50	1	

1	E-UTRA band 26	859	-	869	-27	l 1	1
	Frequency range	2570		2575	+1.6	5	3, 13, 14
	Frequency range	2575		2595	-15.5	5	3, 13, 14
	Frequency range	2595		2620	-40	1	3, 14
CA_5A-12A	E-UTRA Band 2, 5, 13, 14, 17, 22, 23, 24, 25, 30, 31, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	0, 11
	E-UTRA band 4, 10, 41, 66	F _{DL_low}		F _{DL_high}	-50	1	2
		859		869	-30	1	
	E-UTRA band 26				-50	1	3
CA_5A-17A	E-UTRA band 12 E-UTRA Band 2, 5, 13, 14, 17,	F _{DL_low}	-	F _{DL_high}	-50	- '	3
CA_SA-17A	22, 23, 24, 25, 30, 31, 42, 43	F _{DL_low}	-	F _{DL_high}	-50	1	
	E-UTRA band 4, 10, 41, 66	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA band 26	859	-	869	-27	1	
	E-UTRA band 12	F_{DL_low}	-	F_{DL_high}	-50	1	3
CA_7A-20A	E-UTRA Band 1,3, 7, 8, 22, 28, 31, 32, 33, 34, 40, 43, 65, 67	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 20	F_{DL_low}	-	F _{DL_high}	-50	1	3
	E-UTRA Band 42	F_{DL_low}	-	F _{DL_high}	-50	1	2
	Frequency range	2570	-	2575	+1.6	5	3, 13, 14
	Frequency range	2575	_	2595	-15.5	5	3, 13, 14
	Frequency range	2595		2620	-40	1	3, 14
CA 7A-28A	E-UTRA Band 2, 3, 5, 7, 8, 20,						0,
OA_1A-20A	26, 27, 31, 34, 40 E-UTRA Band 1, 4, 10, 22, 32,	F _{DL_low}	-	F _{DL_high}	-50	1	
	42, 43, 65, 66	F_{DL_low}	-	F_{DL_high}	-50	1	2
	E-UTRA Band 1	F _{DL_low}	_	F _{DL high}	-50	1	5, 6
	Frequency range	758	-	773	-32	1	3
	Frequency range	773	-	803	-50	1	
	. , ,	2570		2575	+1.6	5	3, 13, 14
	Frequency range	 	-		-15.5	5	3, 13, 14
	Frequency range	2575	-	2595			
04 404 004	Frequency range	2595	-	2620	-40	1	3, 14
CA_18A-28A	E-UTRA Band 11, 21	F _{DL_low}	-	F _{DL_high}	-50	1	5, 21
	E-UTRA Band 1, 65	F _{DL_low}	-	F _{DL_high}	-50	1	5, 6
	E-UTRA Band 42, 43	F_{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 3, 34	F_{DL_low}	-	F_{DL_high}	-50	1	
	Frequency range	470	-	710	-26.2	6	23
	Frequency range	758	-	773	-32	1	3
	Frequency range	773	-	799	-50	1	
	Frequency range	799	-	803	-40	1	3
	Frequency range	860	-	890	-40	1	
	Frequency range	945	-	960	-50	1	3
	Frequency range	1884.5	-	1915.7	-41	0.3	4
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	_	2645	-50	1	
CA_19A-21A	E-UTRA Band 1, 18, 19, 28, 34,	F _{DL_low}	_	F _{DL high}	-50	1	
	42, 65			- 0	50	1	2.46
	E-UTRA Band 11	F _{DL_low}	<u> </u>	F _{DL_high}	-50	1	3, 16
	E-UTRA Band 21	F _{DL_low}	-	F _{DL_high}	-50	1	16
	Frequency range	860	<u> </u>	890	-40	1	3, 8
	Frequency range	945	-	960	-50	1	
	Frequency range	1884.5	_	1915.7	-41	0.3	4
	Frequency range	2545	-	2575	-50	1	
	Frequency range	2595	_	2645	-50	1	
CA 39A-41A	E-UTRA Band 1, 8, 26, 34, 40, 42, 44	F _{DL_low}	_	F _{DL_high}	-50	1	
	Frequency range	1805	-	1855	-40	1	20
	Frequency range	1855	_	1880	-15.5	5	3, 13, 20
CA_39A-41C	E-UTRA Band 1, 8, 26, 34, 40,				-50	1	
	42, 44	F _{DL low}	-	F _{DL high}	-40	1	20
	Frequency range	1805 1855	-	1855 1880	-40 -15.5	5	20
L	Frequency range E-UTRA Band 34, 40, 42, 44	1855 F _{DL_low}	-	F _{DL_high}	-15.5 -50	1	3, 13, 20
CA_39C-41A	T F-IIIRA Band 3/1 //0 //2 //	H					

- NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd, 4th [or 5th] harmonic spurious emissions. In case the exceptions are allowed due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x L_{CRB} x 180kHz), where N is 2, 3 or 4 for the 2nd, 3rd or 4th harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.
- NOTE 3: These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.
- NOTE 4: Applicable when co-existence with PHS system operating in 1884.5 -1915.7MHz.
- NOTE 5: Applicable when the assigned E-UTRA carrier is confined within 718 MHz and 748 MHz and when the channel bandwidth used is 5 or 10 MHz.
- NOTE 6: As exceptions, measurements with a level up to the applicable requirement of -36 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 3rd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 3rd harmonic totally or partially overlaps the measurement bandwidth (MBW).
- NOTE 7: Applicable when NS_05 in section 6.6.3.3.1 is signalled by the network.
- NOTE 8: Applicable when NS_08 in subclause 6.6.3.3.3 is signalled by the network
- NOTE 9: Whether the applicable frequency range should be 793-805MHz instead of 799-805MHz is TBD.
- NOTE10: N/A
- NOTE 11: This requirement is applicable only for the following cases:
 - for carriers of 5 MHz channel bandwidth when carrier centre frequency (F_c) is within the range 902.5 MHz \leq F_c < 907.5 MHz with an uplink transmission bandwidth less than or equal to 20 RB for carriers of 5 MHz channel bandwidth when carrier centre frequency (F_c) is within the range 907.5 MHz \leq F_c \leq 912.5 MHz without any restriction on uplink transmission bandwidth. for carriers of 10 MHz channel bandwidth when carrier centre frequency (F_c) is F_c = 910 MHz with
 - an uplink transmission bandwidth less than or equal to 32 RB with RB_{start} > 3.
- NOTE 12: This requirement is applicable for any channel bandwidths within the range 1920 1980 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 1927.5 1929.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 1930 1938 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE13: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.
- NOTE 14: This requirement is applicable for any channel bandwidths within the range 2500 2570 MHz with the following restriction: for carriers of 15 MHz bandwidth when carrier centre frequency is within the range 2560.5 2562.5 MHz and for carriers of 20 MHz bandwidth when carrier centre frequency is within the range 2552 2560 MHz the requirement is applicable only for an uplink transmission bandwidth less than or equal to 54 RB.
- NOTE 15: Applicable when NS_15 in subclause 6.6.3.3.8 is signalled by the network.
- NOTE 16: Applicable when NS 09 in subclause 6.6.3.3.4 is signalled by the network
- NOTE 17: This requirement is applicable only when Band 3 transmission frequency is less than or equal to 1765 MHz.
- NOTE 18: This requirement applies when the E-UTRA carrier is confined within 2545-2575MHz or 2595-2645MHz and the channel bandwidth is 10 or 20 MHz
- NOTE 19: Void
- NOTE 20: This requirement is only applicable for carriers with bandwidth confined within 1885-1920 MHz (requirement for carriers with at least 1RB confined within 1880 1885 MHz is not specified). This requirement applies for an uplink transmission bandwidth less than or equal to 54 RB for carriers of 15 MHz bandwidth when carrier center frequency is within the range 1892.5 1894.5 MHz and for carriers of 20 MHz bandwidth when carrier center frequency is within the range 1895 1903 MHz.
- NOTE 21: As exceptions, measurements with a level up to the applicable requirement of -38 dBm/MHz is permitted for each assigned E-UTRA carrier used in the measurement due to 2nd harmonic spurious emissions. An exception is allowed if there is at least one individual RB within the transmission bandwidth (see Figure 5.6-1) for which the 2nd harmonic totally or partially overlaps the measurement bandwidth (MBW).
- NOTE 22: This requirement is applicable in the case of a 10 MHz E-UTRA carrier confined within 703 MHz and 733 MHz, otherwise the requirement of -25 dBm with a measurement bandwidth of 8 MHz applies.
- NOTE 23: This requirement is applicable for 5 and 10 MHz E-UTRA channel bandwidth allocated within 718-728MHz. For carriers of 10 MHz bandwidth, this requirement applies for an uplink transmission bandwidth less than or equal to 30 RB with RBstart > 1 and RBstart < 48.

Table 6.6.3.2A-1: Requirements for intraband carrier aggregation

E-	Spurious emission						
UTRA CA Config uration	Protected band Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE	
CA_1C	E-UTRA Band 1, 7, 8, 11, 18, 19, 20, 21, 22, 26, 27, 28, 31, 32, 38, 40, 41, 42, 43, 44, 65, 67	F _{DL low}	-	F _{DL high}	-50	1	
	E-UTRA Band 3	F _{DL low}	-	F _{DL high}	-50	1	10
CA_3C	E-UTRA Band 1, 7, 8, 20, 26, 27, 28, 31, 32, 33, 34, 38, 41, 43, 44, 65, 67	F_{DL_low}	ı	F_{DL_high}	-50	1	
	E-UTRA Band 3	F_{DL_low}	-	F_{DL_high}	-50	1	10
	E-UTRA Band 22, 42	F_{DL_low}	1	F_{DL_high}	-50	1	2
CA_7C	E-UTRA Band 1, 3, 7, 8, 20, 22, 27, 28, 29, 30. 31, 32, 33, 34, 40, 42, 43, 65, 67	$F_{DL_{low}}$	1	F _{DL high}	-50	1	
CA_8B	E-UTRA Band 1, 20, 28, 31, 32, 33, 34, 38, 39, 40	F _{DL_low}	_	F _{DL_high}	-50	1	
	E-UTRA band 3	F _{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA band 7	F_{DL_low}	-	F _{DL_high}	-50	1	2
	E-UTRA Band 8	F _{DL_low}	-	F _{DL_high}	-50	1	10
	E-UTRA Band 22, 41, 42, 43	$F_{DL_{low}}$		F _{DL_high}	-50	1	2
CA_38C	E-UTRA Band 1,3, 8, 20, 22, 27, 28, 29, 30, 31, 32, 33, 34, 40, 42, 43, 65, 67	F _{DL low}	-	F _{DL high}	-50	1	
CA_39C	E-UTRA Band 22, 34, 40, 41, 42, 44	F _{DL_low}	-	F _{DL_high}	-50	1	
CA_40C	E-UTRA Band 1, 3, 7, 8, 20, 22, 26, 27, 32, 33, 34, 38, 39, 41, 42, 43, 44, 65, 67	F _{DL low}	-	F _{DL high}	-50	1	
CA_41C	E-UTRA Band 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 17, 23, 24, 25, 26, 27, 28, 29, 30, 34, 39, 40, 42, 44, 65, 66	F _{DL_low}	-	F _{DL_high}	-50	1	
CA_42C	E-UTRA Band 1, 2, 3, 4, 5, 7, 8, 10, 11, 18, 19, 20, 21, 25, 26, 27, 28, 31, 32, 33, 34, 38, 40, 41, 44, 65, 66, 67	F _{DL_low}	-	F _{DL_high}	-50	1	
	Frequency range	1884.5	-	1915.7	-41	0.3	

NOTE 1: FDL_low and FDL_high refer to each E-UTRA frequency band specified in Table 5.5-1

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd, 3rd, 4th [or 5th] harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x Lcre x 180kHz), where N is 2, 3, 4, [5] for the 2nd, 3rd, 4th [or 5th] harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval

NOTE 3: To meet these requirements some restriction will be needed for either the operating band or protected band

NOTE 4: N/A

NOTE 5: N/A

NOTE 6: N/A

NOTE 7: N/A

NOTE 8: N/A

NOTE 9: N/A

NOTE 10: The requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

NOTE 11: N/A

NOTE 12: N/A

NOTE 13: N/A NOTE 14: N/A

Spurious emission E-UTRA CA Protected band Frequency range **MBW** NOTE Maximum Configur (MHz) Level (MHz) ation (dBm) E-UTRA Band 2, 4, 5, 7, 10, 12, CA_4A-13, 14, 17, 22, 23, 24, 25, 26, 27, -50 1 F_{DL_low} FDL_high 28, 29, 30, 41, 43, 66 4A E-UTRA Band 42 $F_{\mathsf{DL_low}}$ F_{DL_high} -50

Table 6.6.3.2A-2: Requirements for intraband non-contiguous CA

F_{DL} low and F_{DL} high refer to each E-UTRA frequency band specified in Table 5.5-1 NOTE 1:

NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.6.3.1-2 are permitted for each assigned E-UTRA carrier used in the measurement due to 2nd or 3rd harmonic spurious emissions. Due to spreading of the harmonic emission the exception is also allowed for the first 1 MHz frequency range immediately outside the harmonic emission on both sides of the harmonic emission. This results in an overall exception interval centred at the harmonic emission of (2MHz + N x LCRB x 180kHz), where N is 2 or 3 for the 2nd or 3rd harmonic respectively. The exception is allowed if the measurement bandwidth (MBW) totally or partially overlaps the overall exception interval.

6.6.3.3 Additional spurious emissions

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell handover/broadcast message.

NOTE: For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

6.6.3.3.1 Minimum requirement (network signalled value "NS 05")

When "NS_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.1-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.1-1: Additional requirements (PHS)

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)				Measurement bandwidth	NOTE
	5 MHz	10 MHz	15 MHz	20 MHz		
1884.5 ≤ f ≤1915.7	-41	-41	-41	-41	300 KHz	1

Table 6.6.3.3.1-2: Void

6.6.3.3.2 Minimum requirement (network signalled value "NS 07")

When "NS 07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.2-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.2-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	10 MHz	
769 ≤ f ≤ 775	-57	6.25 kHz
	ns measurement shall be sufficiently powen and ard deviation < 0.5 dB.	er averaged to ensure

6.6.3.3.3 Minimum requirement (network signalled value "NS_08")

When "NS 08" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.3-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.3-1: Additional requirement

Frequency band	Channel ban	Measurement bandwidth			
(MHz)	5MHz	5MHz 10MHz 15MHz			
860 ≤ f ≤ 890	-40	-40	-40	1 MHz	

6.6.3.3.4 Minimum requirement (network signalled value "NS_09")

When "NS 09" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.4-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.4-1: Additional requirement

Frequency band (MHz)	Channel ban	Measurement bandwidth		
	5MHz			
1475.9 ≤ f ≤ 1510.9	-35	-35	-35	1 MHz

NOTE 1: Void.

NOTE 2: To improve measurement accuracy, A-MPR values for NS_09 specified in Table 6.2.4-1 in subclause 6.2.4 are derived based on 100 kHz RBW.

6.6.3.3.5 Minimum requirement (network signalled value "NS_12")

standard deviation < 0.5 dB.

When "NS 12" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.5-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.5-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz	Measurement bandwidth
806 ≤ f ≤ 813.5	-42	6.25 kHz
above 814.2 M	nt applies for E-UTRA carriers with lower chan IHz. measurement shall be sufficiently power avera	· ·

6.6.3.3.6 Minimum requirement (network signalled value "NS_13")

When "NS 13" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.6-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.6-1: Additional requirements

	ncy band IHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
		1.4, 3, 5 MHz	
806 ≤ f ≤ 816		-42	6.25 kHz
	NOTE 1: The requirement applies for E-UTRA carriers with lower chan above 819 MHz.		nnel edge at or
	The emissions standard devia	measurement shall be sufficiently power averation < 0.5 dB.	aged to ensure a

6.6.3.3.7 Minimum requirement (network signalled value "NS_14")

When "NS 14" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.7-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.7-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	10 MHz, 15 MHz	
806 ≤ f ≤ 816	-42	6.25 kHz
NOTE 1: The requirement applies for E-UTRA carriers with lower char above 824 MHz.		nnel edge at or
NOTE 2: The emissions measurement shall be sufficiently power averaged to ensure a standard deviation < 0.5 dB.		

6.6.3.3.8 Minimum requirement (network signalled value "NS_15")

When "NS 15" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.8-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.8-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz	
851 ≤ f ≤ 859	-53	6.25 kHz
NOTE 1: The emissions measurement shall be sufficiently power avera standard deviation < 0.5 dB.		aged to ensure a

6.6.3.3.9 Minimum requirement (network signalled value "NS_16")

When "NS_16" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.9-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.9-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 1.4, 3, 5, 10 MHz	Measurement bandwidth	NOTE
790 ≤ f ≤ 803	-32	1 MHz	

6.6.3.3.10 Minimum requirement (network signalled value "NS_17")

When "NS_17" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.10-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.10-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5. 10 MHz	Measurement bandwidth	NOTE
,	-, -		
470 ≤ f ≤ 710	-26.2	6 MHz	1
NOTE 1: Applica	able when the assigned E-UTRA carri	er is confined within 718	3 MHz
and 748 MHz and when the channel bandwidth used is 5 or 10 MHz			

6.6.3.3.11 Minimum requirement (network signalled value "NS_18")

When "NS_18" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.11-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.11-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	Measurement bandwidth	NOTE
692-698	-26.2	6 MHz	

6.6.3.3.12 Minimum requirement (network signalled value "NS_19")

When "NS_19" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.12-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.12-1: Additional requirements

	Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 3, 5, 10, 15, 20 MHz	Measurement bandwidth	NOTE
ĺ	662 ≤ f ≤ 694	-25	8 MHz	

6.6.3.3.13 Minimum requirement (network signalled value "NS_11")

When "NS_11" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.13-1. These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Table 6.6.3.3.13-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 1.4, 3, 5, 10, 15, 20 MHz	Measurement bandwidth
E-UTRA Band 2	-50	1 MHz
1998 ≤ f ≤ 1999	-21	1 MHz
1997 ≤ f < 1998	-27	1 MHz
1996 ≤ f < 1997	-32	1 MHz
1995 ≤ f < 1996	-37	1 MHz
1990 ≤ f < 1995	-40	1 MHz

6.6.3.3.14 Minimum requirement (network signalled value "NS_20")

When "NS_20" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.14-1. These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Table 6.6.3.3.14-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	Measurement bandwidth
1990 ≤ f < 1999	-40	1 MHz
1999 ≤ f ≤ 2000	-40	NOTE 1
NOTE 1: The measurement bandwidth is 1% of the applicable E-UTRA channel bandwidth.		

6.6.3.3.15 Minimum requirement (network signalled value "NS_21")

When "NS_21" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.15-1. These requirements also apply for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

Table 6.6.3.3.15-1: Additional requirements

Frequency band	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
(MHz)	5, 10 MHz	
2200 ≤ f < 2288	-40	1 MHz
2288 ≤ f < 2292	-37	1 MHz
2292 ≤ f < 2296	-31	1 MHz
2296 ≤ f < 2300	-25	1 MHz
2320 ≤ f < 2324	-25	1 MHz
2324 ≤ f < 2328	-31	1 MHz
2328 ≤ f < 2332	-37	1 MHz
2332 ≤ f ≤ 2395	-40	1 MHz

6.6.3.3.16 Minimum requirement (network signalled value "NS_22")

When "NS 22" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.16-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.16-1: Additional requirement

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	MBW	
	5, 10, 15, 20 MHz		
3400 ≤ f ≤ 3800	-23 (NOTE 1, NOTE 3)	5 MHz	
	-40 (NOTE 2)	1 MHz	
NOTE 1: This requirem	nent applies within an offset between 5 MHz a	nd 25 MHz	
from the low	er and from the upper edge of the channel band	dwidth,	
whenever these frequencies overlap with the specified frequency band.		iency band.	
NOTE 2: This requirem	nent applies from 3400 MHz to 25 MHz below	the lower	
E-UTRA channel edge and from 25 MHz above the upper E-UTRA			
channel edge	channel edge to 3800 MHz.		
NOTE 3: This emission limit might imply risk of harmful interference to UE(s) operating in the protected operating band		o UE(s) operating	

6.6.3.3.17 Minimum requirement (network signalled value "NS_23")

When "NS 23" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.17-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.17-1: Additional requirement

Frequency band (MHz)		Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	MBW
3400 :	≤ f ≤ 3800	-23 (NOTE 1, NOTE 4)	5 MHz
		-40 (NOTE 2)	1 MHz
NOTE 1:	NOTE 1: This requirement applies within an offset between 5 MHz + F _{offset_NS_23} an 25 MHz + F _{offset_NS_23} from the lower and from the upper edges of the channel bandwidth, whenever these frequencies overlap with the specifie frequency band.		jes of the
NOTE 2:	 This requirement applies from 3400 MHz to 25 MHz + F_{offset_NS_23} below the lower E-UTRA channel edge and from 25 MHz + F_{offset_NS_23} above the upper E-UTRA channel edge to 3800 MHz. 		
	5 MHz for 10 9 MHz for 15 12 MHz for 20	/IHz channel BW, MHz channel BW, MHz channel BW and) MHz channel BW.	a to LIE(s)
NOTE 4:		n limit might imply risk of harmful interferenc he protected operating band	e io oe(s)

6.6.3.3.18 Void

Table 6.6.3.3.18-1: Void

6.6.3.3.19 Minimum requirement (network signalled value "NS_04")

When "NS 04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.19-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.19-1: Additional requirements

Frequency band	Channel bandwidth / Spectrum emission limit (dBm) 5, 10, 15, 20 MHz	Measurement bandwidth
2490.5 MHz ≤ f < 2496 MHz	-13	1 MHz
9 kHz < f < 2490.5 MHz	-25	1 MHz

6.6.3.3.20 Minimum requirement (network signalled value "NS_24")

When "NS_24" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.20-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.20-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5 MHz, 10 MHz, 15 MHz, 20 MHz	Measurement bandwidth				
Band 34	-50	MHz				
NOTE 1: This requirement applies at a frequency offset equal or larger than 5 MHz from						

NOTE 1: This requirement applies at a frequency offset equal or larger than 5 MHz from the upper edge of the channel bandwidth, whenever these frequencies overlap with the specified frequency band.

6.6.3.3.21 Minimum requirement (network signalled value "NS_25")

When "NS_25" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.21-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.21-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm) 5 MHz, 10 MHz, 15 MHz, 20 MHz	Measurement bandwidth
Band 34	-40	MHz

NOTE 1: This requirement applies at a frequency offset equal or larger than 5 MHz from the upper edge of the channel bandwidth, whenever these frequencies overlap with the specified frequency band.

6.6.3.3.22 Minimum requirement (network signalled value "NS_26")

When "NS_26" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.22-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.22-1: Additional requirements

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth
	5 MHz, 10 MHz, 15 MHz	
686 ≤ f ≤ 694	-25	8MHz

6.6.3.3.23 - 6.6.3.3.27 Void

6.6.3.3.28 Minimum requirement (network signalled value "NS_36")

When "NS_36" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3.28-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1-1 from the edge of the channel bandwidth.

Table 6.6.3.3.28-1: Additional requirements

Frequency band (MHz)		Channel bandwidth / Spectrum emission limit (dBm)	Measurement bandwidth		
		5 MHz, 10 MHz and 15 MHz			
470) ≤ f ≤ 694	-42	8MHz		
NOTE: For a 5 MHz E-UTRA carrier confined within 698MHz and 703MHz, this requirement shall be met in normal conditions only. The requirement is relaxed to -30dBm in extreme conditions.					

6.6.3.3A Additional spurious emissions for CA

These requirements are specified in terms of an additional spectrum emission requirement. Additional spurious emission requirements are signalled by the network to indicate that the UE shall meet an additional requirement for a specific deployment scenario as part of the cell reconfiguration message.

NOTE:

For measurement conditions at the edge of each frequency range, the lowest frequency of the measurement position in each frequency range should be set at the lowest boundary of the frequency range plus MBW/2. The highest frequency of the measurement position in each frequency range should be set at the highest boundary of the frequency range minus MBW/2. MBW denotes the measurement bandwidth defined for the protected band.

6.6.3.3A.1 Minimum requirement for CA_1C (network signalled value "CA_NS_01")

When "CA_NS_01" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.1-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.1-1: Additional requirements (PHS)

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
E-UTRA band 34	FDL_low	-	FDL_high	-50	1	
Frequency range	1884.5	-	1915.7	-41	0.3	1
NOTE 1: Applicable when the aggregated channel bandwidth is confined within frequency range 1940 – 1980 MHz						

6.6.3.3A.2 Minimum requirement for CA_1C (network signalled value "CA_NS_02")

When "CA_NS_02" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.2-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.2-1: Additional requirements

Protected band	Frequency range (MHz)		nge (MHz)	Maximum Level (dBm)	MBW (MHz)	NOTE
E-UTRA band 34	F _{DL_low}	-	F _{DL_high}	-50	1	
Frequency range	1900	•	1915	-15.5	5	1, 2
Frequency range	1915	•	1920	+1.6	5	1, 2

NOTE 1: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

6.6.3.3A.3 Minimum requirement for CA 1C (network signalled value "CA NS 03")

When "CA_NS_03" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.3-1. This requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.3-1: Additional requirements

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
E-UTRA band 34	F_{DL_low}	ı	F _{DL_high}	-50	1	
Frequency range	1880	ı	1895	-40	1	
Frequency range	1895	-	1915	-15.5	5	1, 2
Frequency range	1915	ı	1920	+1.6	5	1, 2

NOTE 1: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

6.6.3.3A.4 Minimum requirement for CA_38C (network signalled value "CA_NS_05")

When "CA_NS_05" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.4-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth. This requirement is applicable for carriers with aggregated channel bandwidths confined in 2570 - 2615 MHz.

Table 6.6.3.3A.4-1: Additional requirements

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	2620	-	2645	-15.5	5	1, 2, 3
Frequency range	2645	-	2690	-40	1	1, 3

NOTE 1: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

NOTE 3: This requirement is applicable for carriers with aggregated channel bandwidths confined in 2570-2615 MHz.

6.6.3.3A.5 Minimum requirement for CA_7C (network signalled value "CA_NS_06")

When "CA_NS_06" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.5-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.5-1: Additional requirements

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	2570	-	2575	+1.6	5	1, 2
Frequency range	2575	-	2595	-15.5	5	1, 2
Frequency range	2595	-	2620	-40	1	

NOTE 1: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.14-1 from the edge of the channel bandwidth.

NOTE 2: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

6.6.3.3A.6 Minimum requirement for CA_39C and CA_39C-41A (network signalled value "CA_NS_07")

When "CA_NS_07" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.6-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.6-1: Additional requirements

Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
Frequency range	1805	-	1855	-40	1	1
Frequency range	1855	-	1880	-15.5	5	1, 2, 3

NOTE 1: This requirement is applicable for carriers with aggregated channel bandwidths confined in 1885-1920 MHz.

NOTE 2: The requirement also applies for the frequency ranges that are less than FOOB (MHz) in Table 6.6.3.1-1 and Table 6.6.3.1A-1 from the edge of the channel bandwidth.

NOTE 3: For these adjacent bands, the emission limit could imply risk of harmful interference to UE(s) operating in the protected operating band.

6.6.3.3A.7 Minimum requirement for CA_42C (network signalled value "CA_NS_08")

When "CA_NS_08" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.7-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.7-1: Additional requirements

Frequency band (MHz)	Aggregated bandwidth / Spectrum emission limit (dBm) 25, 30, 35, 40 MHz (Note 1)	MBW
3400 ≤ f ≤ 3800	-23 (Note 2, Note 4)	5 MHz
	-40 (Note 3)	1 MHz

NOTE 1: Possible aggregated bandwidth for CA_42C as specified in Table 5.6A.1-1.

NOTE 2: This requirement applies within an offset between 5 MHz and 25 MHz from the lower and from the upper edge of the channel bandwidth, whenever these frequencies overlap with the specified frequency band.

NOTE 3: This requirement applies from 3400 MHz to 25 MHz below the lower E-UTRA channel edge and from 25 MHz above the upper E-UTRA channel edge to 3800 MHz

NOTE 4: This emission limit might imply risk of harmful interference to UE(s) operating in the protected operating band.

6.6.3.3A.8 Minimum requirement for CA_41C (network signalled value "CA_NS_04")

When "CA_NS_04" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.6.3.3A.8-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.6.3.1A-1 from the edge of the aggregated channel bandwidth.

Table 6.6.3.3A.8-1: Additional requirements

Frequency band	Spectrum emission limit (dBm)	Measurement bandwidth
2490.5 MHz ≤ f < 2495 MHz	-13	1 MHz
9 kHz < f < 2490.5	-25	1 MHz
MHz		

6.6.3A Void

<reserved for future use>

6.6.3B Spurious emission for UL-MIMO

For UE supporting UL-MIMO, the requirements for Spurious emissions which are caused by unwanted transmitter effects such as harmonics emission, parasitic emissions, intermodulation products and frequency conversion products are specified at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.6.3 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-1.

If UE is configured for transmission on single-antenna port, the general requirements in subclause 6.6.3 apply.

6.6.3C Void

<reserved for future use>

6.6.3D Spurious emission for ProSe

When UE is configured for E-UTRA ProSe sidelink transmissions non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the requirements in subclause 6.6.3 apply.

When UE is configured for simultaneous E-UTRA ProSe sidelink and E-UTRA uplink transmissions for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, the UE co-existence requirements in Table 6.6.3.2A-0 in subclause 6.6.3.2A apply as specified for the corresponding inter-band aggregation with uplink assigned to two bands.

6.6.3F Spurious emission for category NB1

When UE is configured for category NB1 uplink transmissions the requirements in subclause 6.6.3 apply with an exception that boundary between category NB1 out of band and spurious emission domain shall be $F_{OOB} = 1.7$ MHz.

6.6A Void

6.6B Void

6.7 Transmit intermodulation

The transmit intermodulation performance is a measure of the capability of the transmitter to inhibit the generation of signals in its non linear elements caused by presence of the wanted signal and an interfering signal reaching the transmitter via the antenna.

6.7.1 Minimum requirement

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through E-UTRA rectangular filter with measurement bandwidth shown in Table 6.7.1-1.

The requirement of transmitting intermodulation is prescribed in Table 6.7.1-1.

BW Channel (UL)	5MHz		10MHz		15MHz		20MHz	
Interference Signal Frequency Offset	5MHz	10MHz	10MHz	20MHz	15MHz	30MHz	20MHz	40MHz
Interference CW Signal Level	-40dBc							
Intermodulation Product	-29dBc	-35dBc	-29dBc	-35dBc	-29dBc	-35dBc	-29dBc	-35dBc
Measurement bandwidth	4.5MHz	4.5MHz	9.0MHz	9.0MHz	13.5MHz	13.5MHz	18MHz	18MHz

Table 6.7.1-1: Transmit Intermodulation

6.7.1A Minimum requirement for CA

User Equipment(s) transmitting in close vicinity of each other can produce intermodulation products, which can fall into the UE, or eNode B receive band as an unwanted interfering signal. The UE intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product on both component carriers when an interfering CW signal is added at a level below the wanted signal at each of the transmitter antenna port with the other antenna port(s) if any is terminated. Both the wanted signal power and the intermodulation product power are measured through rectangular filter with measurement bandwidth shown in Table 6.7.1A-1.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the requirement is specified in Table 6.7.1-1 which shall apply on each component carrier with both component carriers active.

For intra-band contiguous carrier aggregation the requirement of transmitting intermodulation is specified in Table 6.7.1A-1.

Table 6.7.1A-1: Transmit Intermodulation

CA bandwidth class(UL)	Ва	and C
Interference Signal Frequency Offset	BWChannel_CA	2*BWChannel_CA
Interference CW Signal Level	-40	OdBc
Intermodulation Product	-29dBc	-35dBc
Measurement bandwidth	BW _{Channel}	CA- 2* BWGB

For combinations of intra-band and inter-band carrier aggregation with three uplink component carriers (up to two contiguously aggregated carriers per band) transmit intermodulations is defined as follows. For the E-UTRA band supporting one component carrier the requirement specified in Table 6.7.1-1 apply. For the E-UTRA band supporting two contiguous component carriers the requirements specified in Table 6.7.1A-1 apply.

6.7.1B Minimum requirement for UL-MIMO

For UE supporting UL-MIMO, the transmit intermodulation requirements are specified at each transmit antenna connector and the wanted signal is defined as the sum of output power at each transmit antenna connector.

For UEs with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the requirements in subclause 6.7.1 apply to each transmit antenna connector. The requirements shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2.

If UE is configured for transmission on single-antenna port, the requirements in subclause 6.7.1 apply.

6.7.1F Minimum requirement for category NB1

The UE category NB1 transmitter intermodulation attenuation is defined by the ratio of the mean power of the wanted signal to the mean power of the intermodulation product as defined in Table 6.7.1F-1 when an interfering CW signal is added at a level below the wanted signal at the transmitter antenna port. Both the wanted signal power and the intermodulation product power are measured through rectangular filter with measurement bandwidth shown in Table 6.7.1F-1.

Table 6.7.1F-1: UE category NB1 transmitter IM requirement

Parameters for transmitter intermodulation			
BW Channel (UL)	15 kHz (1 tone at se	ub-carrier 5 or 6)	
Interference Signal Frequency Offset	180 kHz	360 kHz	
Interference CW Signal Level	-40dBc		
Intermodulation Product	-20 dBc	-39 dBc	
Measurement bandwidth	30 kHz	30 kHz	

- 6.8 Void
- 6.8.1 Void
- 6.8A Void

6.8B Time alignment error for UL-MIMO

For UE(s) with multiple transmit antenna connectors supporting UL-MIMO, this requirement applies to frame timing differences between transmissions on multiple transmit antenna connectors in the closed-loop spatial multiplexing scheme.

The time alignment error (TAE) is defined as the average frame timing difference between any two transmissions on different transmit antenna connectors.

6.8B.1 Minimum Requirements

For UE(s) with multiple transmit antenna connectors, the Time Alignment Error (TAE) shall not exceed 130 ns.

7 Receiver characteristics

7.1 General

Unless otherwise stated the receiver characteristics are specified at the antenna connector(s) of the UE. For UE(s) with an integral antenna only, a reference antenna(s) with a gain of 0 dBi is assumed for each antenna port(s). UE with an integral antenna(s) may be taken into account by converting these power levels into field strength requirements, assuming a 0 dBi gain antenna. For UEs with more than one receiver antenna connector, identical interfering signals shall be applied to each receiver antenna port if more than one of these is used (diversity).

The levels of the test signal applied to each of the antenna connectors shall be as defined in the respective sections below.

With the exception of subclause 7.3, the requirements shall be verified with the network signalling value NS_01 configured (Table 6.2.4-1).

All the parameters in clause 7 are defined using the UL reference measurement channels specified in Annexes A.2.2 and A.2.3, the DL reference measurement channels specified in Annex A.3.2 and using the set-up specified in Annex C.3.1.

For the additional requirements for intra-band non-contiguous carrier aggregation of two sub-blocks, an in-gap test refers to the case when the interfering signal is located at a negative offset with respect to the assigned lowest channel frequency of the highest sub-block and located at a positive offset with respect to the assigned highest channel frequency of the lowest sub-block.

For the additional requirements for intra-band non-contiguous carrier aggregation of two sub-blocks, an out-of-gap test refers to the case when the interfering signal(s) is (are) located at a positive offset with respect to the assigned channel frequency of the highest carrier frequency, or located at a negative offset with respect to the assigned channel frequency of the lowest carrier frequency.

For the additional requirements for intra-band non-contiguous carrier aggregation of two sub-blocks with channel bandwidth larger than or equal to 5 MHz, the existing adjacent channel selectivity requirements, in-band blocking requirements (for each case), and narrow band blocking requirements apply for in-gap tests only if the corresponding interferer frequency offsets with respect to the two measured carriers satisfy the following condition in relation to the sub-block gap size W_{gap} for at least one of these carriers j=1,2, so that the interferer frequency position does not change the nature of the core requirement tested:

 $Wgap \ge 2 \cdot |FInterferer (offset)_j| - BWChannel(j)$

where F_{Interferer (offset),j} for a sub-block with a single component carrier is the interferer frequency offset with respect to carrier *j* as specified in subclause 7.5.1, subclause 7.6.1 and subclause 7.6.3 for the respective requirement and BW_{Channel(j)} the channel bandwidth of carrier *j*. F_{Interferer (offset),j} for a sub-block with two or more contiguous component carriers is the interference frequency offset with respect to the carrier adjacent to the gap is specified in subclause 7.5.1A, 7.6.1A and 7.6.3A. The interferer frequency offsets for adjacent channel selectivity, each in-band blocking case and narrow- band blocking shall be tested separately with a single in-gap interferer at a time.

For a ProSe UE that supports both ProSe Direct Discovery and ProSe Direct Communication, the receiver characteristics specified in clause 7 for ProSe Direct Communication shall apply.

For ProSe Direct Discovery and ProSe Direct Communication on E-UTRA ProSe operating bands that correspond to TDD E-UTRA operating bands as specified in subclause 5.5D, the only additional requirement for ProSe specified in subclause 7.4.1D is applicable.

7.2 Diversity characteristics

The requirements in Section 7 assume that the receiver is equipped with two Rx port as a baseline. These requirements apply to all UE categories unless stated otherwise. Additional requirements apply for UE(s) equipped with four Rx ports. These additional requirements also apply for supported band combinations for which the UE can operate using up to four Rx ports while configured with carrier aggregation. With the exception of subclause 7.9 all requirements shall be verified by using both (all) antenna ports simultaneously.

NOTE: for an operating band in which the UE can operate using up to four Rx ports, it suffices to verify for conformance the additional requirements applicable for four Rx ports [except for REFSENS].

NOTE: Implementation of 4 antenna ports for all operating bands supported by the UE is not mandated.

For a category 0, a category [M 1] and category NB1 UE the requirements in Section 7 assume that the receiver is equipped with single Rx port.

7.3 Reference sensitivity power level

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories except category 0 and category [M1], or to the single antenna port for UE category 0 and UE category [M1], at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

The throughput for the REFSENS test is measured based on the Transmission Mode 1 unless specified otherwise.

7.3.1 Minimum requirements (QPSK)

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2

Table 7.3.1-1: Reference sensitivity QPSK PREFSENS

Channel bandwidth							
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
1			-100	-97	-95.2	-94	FDD
2	-102.7	-99.7	-98	-95	-93.2	-92	FDD
3	-101.7	-98.7	-97	-94	-92.2	-91	FDD
4	-104.7	-101.7	-100	-97	-95.2	-94	FDD
5	-103.2	-100.2	-98	-95			FDD
6			-100	-97			FDD
7			-98	-95	-93.2	-92	FDD
8	-102.2	-99.2	-97	-94			FDD
9			-99	-96	-94.2	-93	FDD
10			-100	-97	-95.2	-94	FDD
11			-100	-97			FDD
12	-101.7	-98.7	-97	-94			FDD
13			-97	-94			FDD
14			-97	-94			FDD
17			-97	-94			FDD
18			-100 ⁷	-97 ⁷	-95.2 ⁷		FDD
19			-100	-97	-95.2		FDD
20			-97	-94	-91.2	-90	FDD
21			-100	-97	-95.2		FDD
22			-97	-94	-92.2	-91	FDD
23	-104.7	-101.7	-100	-97	-95.2	-94	FDD
24	-		-100	-97			FDD
25	-101.2	-98.2	-96.5	-93.5	-91.7	-90.5	FDD
26	-102.7	-99.7	-97.5 ⁶	-94.5 ⁶	-92.7 ⁶		FDD
27	-103.2	-100.2	-98	-95			FDD
28		-100.2	-98.5	-95.5	-93.7	-91	FDD
30			-99	-96			FDD
31	-99.0	-95.7	-93.5				FDD
33			-100	-97	-95.2	-94	TDD
34			-100	-97	-95.2		TDD
35	-106.2	-102.2	-100	-97	-95.2	-94	TDD
36	-106.2	-102.2	-100	-97	-95.2	-94	TDD
37	100.2	102.2	-100	-97	-95.2	-94	TDD
38			-100	-97	-95.2	-94	TDD
39			-100	-97	-95.2	-94	TDD
40			-100	-97	-95.2	-94	TDD
41			-98	-95	-93.2	-92	TDD
42			-99	-96	-94.2	-93	TDD
43			-99	-96	-94.2	-93	TDD
44		[-100.2]	[-98]	[-95]	[-93.2]	[-92]	TDD
45		[100.2]	-100	-97	-95.2	-94	TDD
			-100	-31	-93.2	-34	טטו
 65	-104.2	-101.2	-00.5	-06 5	-017	-03 5	EDD
65 66	-104.2 -104.2	-101.2 -101.2	-99.5 -99.5	-96.5 -96.5	-94.7 -94.7	-93.5 -93.5	FDD FDD

NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

NOTE 3:	The signal power is specified per port
NOTE 4:	For the UE which supports both Band 3 and Band 9 the reference sensitivity
	level is FFS.
NOTE 5:	For the UE which supports both Band 11 and Band 21 the reference sensitivity
	level is FFS.
NOTE 6:	⁶ indicates that the requirement is modified by -0.5 dB when the carrier
	frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.
NOTE 7:	For a UE that support both Band 18 and Band 26, the reference sensitivity level
	for Band 26 applies for the applicable channel bandwidths.

For UE(s) equipped with 4 antenna ports, the minimum requirement for reference sensitivity in Table 7.3.1-1 shall be modified by the amount given in ΔRIB , 4R in Table 7.3.1-1a for the applicable E-UTRA bands.

Table 7.3.1-1a: ΔR_{IB,4R}

E-UTRA Band	ΔR _{IB,4R} [dB]
1, 2, 3, 7, 20, 39, 41	- 2.7
42	- 2.2

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.1-1 (two antenna ports) and Table 7.3.1-1a (four antenna ports) shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.1-2.

NOTE: Table 7.3.1-2 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of uplink and downlink allocated resource blocks will be practically constrained by other factors. Typical receiver sensitivity performance with HARQ retransmission enabled and using a residual BLER metric relevant for e.g. Speech Services is given in the Annex G (informative). For the UE which supports inter-band carrier aggregation configuration with the uplink in one or two E-UTRA bands, the minimum requirement for reference sensitivity in Table 7.3.1-1 and Table 7.3.1-1a shall be increased by the amount given in $\Delta R_{IB,c}$ in Table 7.3.1-1A, Table 7.3.1-1B and Table 7.3.1-1C for the applicable E-UTRA bands.

Table 7.3.1-1A: ΔR_{IB,c} (two bands)

Inter-band CA Configuration	E-UTRA Band	ΔR _{IB,c} [dB]
CA_1A-3A	1 3	0 0
CA_1A-3C	1 3	0
CA_1A-5A	1 5	0
CA_1A-7A	1 7	0
CA_1A-7C	1 7	0
CA_1A-8A	1 8	0
CA_1A-11A	1 1 11	0
CA_1A-18A	1 18	0
CA_1A-19A	1 1 19	0 0
CA_1A-20A	1 20	0 0
CA_1A-21A	1 21	0 0
CA_1A-26A	1 26	0 0
CA_1A-28A	1 28	0 0.2
CA_1A-40A	1 40	0 0
CA_1A-41A ⁸	1 41	0
CA_1A-41C ⁸	1 41	0
CA_1A-42A	1 42	0 0.5
CA_1A-42C	1 42	0 0 0.5
CA_1A-46A	1	0
CA_2A-4A	4	0.3
CA_2A-2A-4A	4	0.3 0.3
CA_2A-4A-4A	4	0.3 0.3
CA_2A-2A-4A- 4A	2 4	0.3
CA_2A-5A	2 5	0
CA_2A-2A-5A	<u>2</u> 5	0 0
CA_2C-5A	2 5	0
CA_2A-7A	2 7	0 0
CA_2A-12A	2 12	0 0
CA_2A-2A-12A	2 12	0 0
CA_2A-2A-12B	2 12	0 0
CA_2A-12B	2 12	0 0

CA_2C-12A	2	0
	12 2	0
CA_2A-13A	13	0
CA_2A-2A-13A	2	0
CA_2A-2A-13A	13	0
CA_2A-17A	2	0
_	17 2	0.5 0
CA_2A-28A	28	0
CA_2A-29A	2	0
CA_2C-29A	2	0
CA_2A-30A	2	0.4
_ CA_2A-46A	30 2	0.5
	2	0.4
CA_2C-30A	30	0.5
CA_3A-5A	3	0
CA_3A-5A	5	0
CA_3C-5A	3	0
	5	0
CA_3A-7A	<u>3</u> 7	0
04 04 ==	3	0
CA_3A-7B	7	0
CA_3A-7C	3	0
0A_0A-10	7	0
CA_3C-7A	<u>3</u> 7	0
	3	0
CA_3C-7C	7	0
CA 2A 9A	3	0
CA_3A-8A	8	0
CA_3A-3A-8A	3	0
_	8 3	0
CA_3A-19A	19	0
CA 2A 20A	3	0
CA_3A-20A	20	0
CA_3A-26A	3	0
51-211-211	26 3	0
CA_3A-27A	27	0
21 21 221	3	0
CA_3A-28A	28	0
CA_3C-28A	3	0
5. t_00 20/ t	28	0
CA_3A-31A	3	0.2
	31 3	0.2
CA_3A-38A	38	0
CA_3A-40A	3	0
UA_3A-4UA	40	0
CA_3A-40C	3	0
	40	0
CA_3A-41A	3	0 0 ¹⁰
5. <u>-</u> 5. 71. 71. 7	41	0.5 ¹¹
	3	0
CA_3A-41C	41	010
		0.5 ¹¹
CA_3A-42A	3 42	0.2
	3	0.5 0.2
CA_3A-42C	42	0.5
		0.0

CA_3A-46A	3	0
	4	0
CA_4A-5A	5	0
CA 4A 4A 5A	4	0
CA_4A-4A-5A	5	0
CA_4A-7A	4	0.5
O/(_ + /(//(7	0.5
CA_4A-4A-7A	4	0.5
	7 4	0.5
CA_4A-12A	12	0 0.5
	4	0.5
CA_4A-12B	12	0.5
04 44 44 404	4	0
CA_4A-4A-12A	12	0.5
CA_4A-13A	4	0
CA_4A-13A	13	0
CA 4A-4A-13A	4	0
O/(_+/(+/(10/(13	0
CA_4A-17A	4	0
	17	0.5
CA_4A-27A	4	0
	27	0
CA_4A-28A	28	0.2
CA_4A-29A	4	0.2
CA_4A-4A-29A	4	0
	4	0.4
CA_4A-30A	30	0.5
CA 4A 4A 20A	4	0.4
CA_4A-4A-30A	30	0.5
CA_4A-46A	4	0
CA_5A-7A	5	0
	7	0
CA_5A-12A	5	0.5
	12 5	0.3 0.5
CA_5A-12B	12	0.3
	5	0
CA_5A-13A	13	0
CA	5	0.5
CA_5A-17A	17	0.3
CA_5A-25A	5	0
	25	0
CA_5A-29A	5	0
CA_5A-30A	5	0
	30	0
CA_5A-38A	5 38	0
	5	0
CA_5A-40A	40	0
04 54 100	5	0
CA_5A-40C	40	0
CA 7A 9A	7	0
CA_7A-8A	8	0.2
CA_7A-12A	7	0
<u> </u>	12	0
CA_7A-20A	7	0
- -	20	0
CA_7A-22A	7 22	0 0.5
	7	0.5
CA_7A-28A	28	0
04 77 55	7	0
CA_7B-28A	28	0
	<u> </u>	-

T		
CA_7C-28A	7	0
	28	0
CA_7A-40A	7 40	0 0.5
	7	0.3
CA_7A-40C	40	0.5
04 74 404	7	0
CA_7A-42A	42	0.5
CA_7A-42A-	7	0
42A	42	0.5
CA_7A-46A	7	0
CA_8A-11A	8	0
	11 8	0
CA_8A-20A	20	0
	8	0
CA_8A-40A	40	0
CA 9A 44A	8	0
CA_8A-41A	41	0
CA_8A-41C	8	0
0/1_0/1410	41	0
CA_8A-42A	8	0.2
_	42	0.5 0.2
CA_8A-42C	8 42	0.2
	11	0.3
CA_11A-18A	18	0
04 404 054	12	0
CA_12A-25A	25	0
CA_12A-30A	12	0
UA_12A-30A	30	0
CA_18A-28A ⁹	18	0
	28	0
CA_19A-21A	19 21	0
	19	0
CA_19A-28A ⁹	28	0
04 404 404	19	0
CA_19A-42A	42	0.5
CA_19A-42C	19	0
CA_19A-42C	42	0.5
CA_20A-31A	20	0
	31	0
CA_20A-32A	20	0
CA_20A-38A	20 38	0
	20	0
CA_20A-40A	40	0
CA 20A 40A	20	0
CA_20A-42A	42	0.5
CA_20A-42A-	20	0
42A	42	0.5
CA_20A-67A	20	0
CA_21A-42A	21	0
	42	0.5
CA_21A-42C	21 42	0 0.5
CA_23A-29A	23	0.3
	25	0
CA_25A-26A	26	0
CA 25A 44A2	25	0
CA_25A-41A ⁸	41	0
CA_25A-41C ⁸	25	0
	41	0
CA_25A-41D ⁸	25	0

1		
	41	0
CA_26A-41A	26	0
07(_207(117)	41	0
CA_26A-41C	26	0
0/(_20/(110	41	0
CA_28A-40A	28	0
O/(_20/(+0/(40	0
CA_28A-40C	28	0
OA_20A-400	40	0
CA_28A-40D	28	0
CA_20A-40D	40	0
CA_28A-41A	28	0
CA_20A-41A	41	0
CA 20A 41C	28	0
CA_28A-41C	41	0
CA 20A 42A	28	0.2
CA_28A-42A	42	0.5
04 004 400	28	0.2
CA_28A-42C	42	0.5
CA_29A-30A	30	0
	38	0.5^{4}
CA_38A-40A	40	0.5^{4}
CA_38A-40A-	38	0.5^4
40A	40	0.5 ⁴
	38	0.5 ⁴
CA_38A-40C	40	0.54
	39	0.24
CA_39A-41A	41	0.24
	39	0.2 ⁷
CA_39A-41A	41	0.2 ⁷
	39	0.24
CA_39A-41C	41	0.24
	39	0.27
CA_39A-41C	41	0.27
	39	0.24
CA_39A-41D	41	0.24
	39	0.24
CA_39C-41A	41	0.24
	39	0.2 0.2 ⁷
CA_39C-41A	41	0.2
		0.2 0.2 ⁴
CA_39C-41C	39	0.24
	41	0.2
CA_41A-42A	41	
	42	0.54
CA_41A-42C	41	0.44
	42	0.54
CA_41C-42A	41	0.44
_	42	0.54
CA_41C-42C	41	0.44
	42	0.54
CA_41A-46A	41	0
CA_42A-46A	42	[0]

NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations

NOTE 2: The above additional tolerances also apply in intra-band and non-aggregated operation for the supported E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations

NOTE 3: In case the UE supports more than one of the above 2DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 2DL inter-band carrier aggregation configurations then:

- When the E-UTRA operating band frequency range is ≤ 1GHz, the applicable additional tolerance shall be the average of the 2DL tolerances in Table 7.3.1-1A, truncated to one decimal place that would apply for that operating band among the supported 2DL CA configurations. In case there

- is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 2DL carrier aggregation configurations involving such band shall be applied
- When the E-UTRA operating band frequency range is >1GHz, the applicable additional tolerance shall be the maximum 2DL tolerance in Table 7.3.1-1A that would apply for that operating band among the supported 2DL CA configurations
- NOTE 4: Only applicable for UE supporting inter-band carrier aggregation with uplink in one E-UTRA band and without simultaneous Rx/Tx.
- NOTE 5: Unless otherwise specified, in case the UE supports more than one of the above 3DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 3DL inter-band carrier aggregation configurations then:
 - When the E-UTRA operating band frequency range is ≤ 1GHz and the tolerances are the same, the value applies to the band. If the tolerances are different, the applicable additional 3DL tolerance is FFS. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 3DL carrier aggregation configurations involving such band shall be applied
 - When the E-UTRA operating band frequency range is >1GHz, the applicable additional 3DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 3DL CA configurations.
- NOTE 6: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.
- NOTE 7: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx.
- NOTE 8: Only applicable for UE supporting inter-band carrier aggregation with the uplink active in the FDD band.
- NOTE 9: For Band 28, the requirements only apply for the restricted frequency range specified for this CA configuration (Table 5.5A-2).
- NOTE 10: The requirement is applied for UE transmitting on the frequency range of 2545-2690MHz.
- NOTE 11: The requirement is applied for UE transmitting on the frequency range of 2496-2545MHz.

Table 7.3.1-1B: $\Delta R_{IB,c}$ (three bands)

Inter-band CA Configuration	E-UTRA Band	ΔR _{IB,c} [dB]
CA_1A-3A-5A	1	0
	3	0
	5	0
CA_1A-3A-7A	1	0
	3	0
	7	0
	1	0
CA_1A-3A-7C	3	0
	7	0
	1	0
CA_1A-3A-8A	3	0
	8	0
	1	0
CA_1A-3A-19A	3	0
	19	0
	1	0
CA_1A-3A-20A	3	0
	20	0
	1	0
CA_1A-3A-26A	3	0
_	26	0
	1	0
CA_1A-3A-28A	3	0
	28	0.2
	1	0
CA_1A-3A-40A	3	0
	40	0
	1	0.2
CA_1A-3A-42A	3	0.2
0/_1/\ 0/\\ 42/\	42	0.5
	1	0.2
CA_1A-3A-42C	3	0.2
UN_1N-3N-420	42	0.5
	1	0.5
CA_1A-5A-7A	5	0
CA_TA-SA-TA	7	0
CA_1A-5A-40A	1	0
CA_1A-5A-40A	5 40	0
		0
CA_1A-7A-8A	1	0
	7	0
	8	0.2
CA 1A 7A 20A	<u> </u>	0
CA_1A-7A-20A		0
	20	0
CA 4A 7A CCA	1	0
CA_1A-7A-28A	7	0
	28	0.2
04 44 70 55:	1	0
CA_1A-7C-28A	7	0
	28	0.2
	1	0
CA_1A-8A-11A	8	0
	11	0
	1	0
CA_1A-8A-40A	8	0
	40	0
	1	0
CA_1A-11A-18A	11	0
	18	0
CA_1A-18A-28A	1	0

18		10	0
CA_1A-19A-21A 1 0 19 0 21 0 1 0 CA_1A-19A-28A 19 0 1 0 0 CA_1A-19A-42A 19 0 1 0 0 42 0.5 1 1 0 0 42 0.5 1 0 0 42 0.5 1 0 0 42 0.5 0 1 0 0 42 0.5 0 1 0 0 42 0.5 0 1 0 0 CA_1A-21A-42A 2 0.5 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 2		18	0
CA_1A-19A-21A			
21	CA_1A-19A-21A	1	0
CA_1A-19A-28A 1 0 28 0 CA_1A-19A-42A 1 0 1 0 0 CA_1A-19A-42C 19 0 1 0 0 42 0.5 0 1 0 0 42 0.5 0 1 0 0 42 0.5 0 1 0 0 42 0.5 0 1 0 0 42 0.5 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0		19	0
CA_1A-19A-28A 1 0 28 0 CA_1A-19A-42A 1 0 1 0 0 CA_1A-19A-42C 19 0 1 0 0 42 0.5 0 1 0 0 42 0.5 0 1 0 0 42 0.5 0 1 0 0 42 0.5 0 1 0 0 42 0.5 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0 2 0.3 0		21	0
CA_1A-19A-28A			
CA_1A-19A-42A 1 0 CA_1A-19A-42A 19 0 42 0.5 1 1 0 0 CA_1A-19A-42C 19 0 1 0 0 CA_1A-21A-42A 21 0 42 0.5 1 CA_1A-21A-42C 21 0 1 0 0 CA_1A-21A-42C 21 0 1 0 0 42 0.5 0 2 0.3 0 2 0.3 0 CA_2A-2A-4A-12A 4 0.3 CA_2A-4A-5A 4 0.3 CA_2A-4A-5A 4 0.3 CA_2A-4A-5A 4 0.3 CA_2A-4A-7A 4 0.3 CA_2A-4A-12A 4 0.3 CA_2A-4A-12A 4 0.3 CA_2A-4A-12A 4 0.3 CA_2A-4A-13A 12 0.5	CA_1A-19A-28A	•	I .
CA_1A-19A-42A			
CA_1A-19A-42A			
CA_1A-19A-42C 1 0 1 0 0 42 0.5 1 0 CA_1A-21A-42A 21 0 1 0 0 CA_1A-21A-42C 21 0 CA_2A-2A-4A-12A 4 0.3 CA_2A-2A-4A-12A 4 0.3 12 0.5 2 2 0.3 0 CA_2A-4A-5A 4 0.3 5 0 0 CA_2A-2A-4A-5A 4 0.3 5 0 0 CA_2A-4A-4A-5A 5 0 5 0 0 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 5 0 0 2 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-12A 4 0.5 0 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 0.5 0 2 0.3 0 2 0.3 0 2 0.3 0 2 <		1	0
CA_1A-19A-42C 19 0 19 0 0 42 0.5 1 1 0 0 CA_1A-21A-42A 21 0 CA_1A-21A-42C 1 0 CA_1A-21A-42C 21 0 42 0.5 2 CA_2A-2A-4A-12A 4 0.3 12 0.5 2 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 <tr< td=""><td>CA_1A-19A-42A</td><td>19</td><td>0</td></tr<>	CA_1A-19A-42A	19	0
CA_1A-19A-42C 19 0 19 0 0 42 0.5 1 1 0 0 CA_1A-21A-42A 21 0 CA_1A-21A-42C 1 0 CA_1A-21A-42C 21 0 42 0.5 2 CA_2A-2A-4A-12A 4 0.3 12 0.5 2 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 2 0.3 0.0 <tr< td=""><td></td><td>42</td><td>0.5</td></tr<>		42	0.5
CA_1A-19A-42C			
42	CA 1A 10A 42C		
CA_1A-21A-42A 1 0 CA_1A-21A-42A 21 0 CA_1A-21A-42C 1 0 CA_2A-2A-4A-12A 4 0.3 CA_2A-2A-4A-12A 4 0.3 CA_2A-4A-5A 4 0.3 CA_2A-4A-5A 5 0 CA_2A-2A-4A-5A 4 0.3 CA_2A-2A-4A-5A 5 0 CA_2A-4A-4A-5A 5 0 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 5 0 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 5 0 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-12A 4 0.5 CA_2A-4A-12A 4 0.3 CA_2A-4A-12A 4 0.3 CA_2A-4A-13A 4 0.3 CA_2A-4A-29A 2 0.	CA_1A-19A-42C		
CA_1A-21A-42A			
CA_1A-21A-42C CA_1A-21A-42C CA_1A-21A-42C CA_2A-2A-4A-12A CA_2A-2A-4A-12A CA_2A-4A-5A CA_2A-4A-5A CA_2A-4A-5A CA_2A-4A-4A-5A CA_2A-4A-12A CA_2A-4A-13A CA_2A-5A-12A CA_2A-5A-12A CA_2A-5A-12A CA_2A-5A-12A CA_2A-5A-12A CA_2A-5A-13A CA_2A-5A-13A CA_2A-5A-13A CA_2A-5A-13A CA_2A-5A-13A CA_2A-5A-13A CA_2A-5A-29A CA_2A-5A-29A CA_2A-5A-3AA	1		
CA_1A-21A-42C 1 0 CA_1A-21A-42C 21 0 42 0.5 2 CA_2A-2A-4A-12A 4 0.3 12 0.5 2 CA_2A-4A-5A 4 0.3 5 0 0 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-7A 4 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.	CA_1A-21A-42A	21	0
CA_1A-21A-42C 1 0 CA_1A-21A-42C 21 0 42 0.5 2 CA_2A-2A-4A-12A 4 0.3 12 0.5 2 CA_2A-4A-5A 4 0.3 5 0 0 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-7A 4 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.5 2 0.3 0.		42	0.5
CA_1A-21A-42C			
CA_2A-2A-4A-12A	CA 1A 21A 42C	•	
CA_2A-2A-4A-12A 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 2 CA_2A-4A-5A 4 0.3 CA_2A-2A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-7A 4 0.5 7 0.5 0.3 CA_2A-4A-12A 4 0.3 CA_2A-4A-3A 4 0.3 CA_2A-4A-13A 4 0.3 CA_2A-4A-29A 2 0.3 CA_2A-4A-29A 4 0.3 CA_2A-4A-30A 4 0.4 CA_2A-5A-12A 5 0.5 12 0.3 CA_2A-5A-12A	CA_1A-21A-42C		
CA_2A-2A-4A-12A			
12 0.5 2 0.3 CA_2A-4A-5A 4 0.3 5 0 2 0.3 CA_2A-2A-4A-5A 4 0.3 5 0 2 0.3 CA_2A-4A-4A-5A 4 0.3 5 0 2 0.3 CA_2A-4A-7A 4 0.5 7 0.5 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 2 0.3 CA_2A-4A-13A 4 0.3 CA_2A-4A-29A 2 0.3 CA_2A-4A-29A 4 0.4 0.3 0.5 0.5 2 0.4 CA_2A-5A-12A 5 <td< td=""><td rowspan="3">CA_2A-2A-4A-12A</td><td></td><td></td></td<>	CA_2A-2A-4A-12A		
12 0.5 2 0.3 CA_2A-4A-5A 4 0.3 5 0 2 0.3 CA_2A-2A-4A-5A 4 0.3 5 0 2 0.3 CA_2A-4A-4A-5A 4 0.3 5 0 2 0.3 CA_2A-4A-7A 4 0.5 7 0.5 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 2 0.3 CA_2A-4A-13A 4 0.3 CA_2A-4A-29A 2 0.3 CA_2A-4A-29A 4 0.4 0.3 0.5 0.5 2 0.4 CA_2A-5A-12A 5 <td< td=""><td>4</td><td>0.3</td></td<>		4	0.3
CA_2A-4A-5A 2 0.3 CA_2A-2A-4A-5A 4 0.3 CA_2A-2A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-7A 4 0.3 CA_2A-4A-7A 4 0.5 7 0.5 0.3 CA_2A-4A-12A 4 0.3 CA_2A-4A-12A 4 0.3 CA_2A-4A-12A 4 0.3 CA_2A-4A-13A 4 0.3 CA_2A-4A-13A 4 0.3 CA_2A-4A-29A 4 0.3 CA_2A-4A-30A 4 0.4 CA_2A-5A-12A 5 0.5 CA_2A-5A-12B 5 0.5 CA_2A-5A-12B 5 0.5		12	
CA_2A-4A-5A 4 0.3 5 0 CA_2A-2A-4A-5A 4 0.3 5 0 CA_2A-4A-4A-5A 4 0.3 CA_2A-4A-4A-5A 4 0.3 5 0 CA_2A-4A-7A 4 0.5 7 0.5 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 2 0.3 CA_2A-4A-12A 4 0.3 12 0.5 2 0.3 CA_2A-4A-13A 4 0.3 13 0 CA_2A-4A-29A 4 0.3 2 0.3 CA_2A-4A-30A 4 0.4 30 0.5 2 0 CA_2A-5A-12A 5 0.5 12 0.3 CA_2A-5A-12A 5 0.5 12 0.3 CA_2A-5A-12B 5 0.5 12 0.3 CA_2A-5A-13A 5 0 CA_2A-5A-29A 5 0 CA_2A-5A-29A 5 0 CA_2A-5A-30A 2 0 CA_2A-5A-30A 2 0<			
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12 0.3 2 0.3 CA_2A-2A-5A-12A 5 0.5 12 0.3 2 0 CA_2A-5A-12B 5 0.5 12 0.3 12 0.3 2 0 CA_2A-5A-13A 5 0 CA_2A-5A-29A 2 0 CA_2A-5A-30A 2 0.4			0.5
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CA_2A-2A-5A-12A 5 0.5 12 0.3 2 0 CA_2A-5A-12B 5 0.5 12 0.3 2 0 CA_2A-5A-13A 5 0 CA_2A-5A-29A 2 0 CA_2A-5A-30A 2 0.4			
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CA_2A-5A-12B 2 0 5 0.5 12 0.3 2 0 CA_2A-5A-13A 5 0 13 0 CA_2A-5A-29A 2 0 CA_2A-5A-30A 2 0.4	CA_2A-2A-5A-12A		
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CA_2A-5A-12B 5 0.5 12 0.3 2 0 CA_2A-5A-13A 5 0 13 0 CA_2A-5A-29A 2 0 CA_2A-5A-30A 2 0.4		2	0
12 0.3 2 0 CA_2A-5A-13A 5 0 13 0 CA_2A-5A-29A 2 0 CA_2A-5A-30A 2 0.4	CA 2A-5A-12B		
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13 0 CA_2A-5A-29A 2 0 CA_2A-5A-30A 2 0.4			
CA_2A-5A-29A 2 0 CA_2A-5A-30A 2 0.4	CA_2A-5A-13A	5	0
CA_2A-5A-29A 2 0 CA_2A-5A-30A 2 0.4		13	0
CA_ZA-5A-29A			
CA 2A-5A-30A 2 0.4	CA_2A-5A-29A —		
			_
5 0	CA 2A-5A-30A		
		5	0

	20	0.5
	30 2	0.5 0.4
CA_2C-5A-30A	5	0.4
CA_2C-3A-30A	30	0.5
	2	0.5
CA_2A-7A-12A	<u>2</u> 7	0
	12	0
	2	0.4
04 04 404 004		
CA_2A-12A-30A	12	0
	30	0.5
CA_2C-12A-30A	<u>2</u> 12	0.4
CA_2C-12A-30A		0 0.5
	30 2	0.5
CA_2A-29A-30A ——		
	30	0.5
CA_2C-29A-30A	2	0.4
	30	0.5
CA_3A-5A-40A	1	0
	5	0
	40	0
CA_3A-7A-8A	3	0
	7	0
	8	0.2
	3	0
CA_3A-7A-20A	7	0
	20	0
	3	0
CA_3A-7A-28A	7	0
	28	0
	3	0
CA_3A-7C-28A	7	0
	28	0
	3	0
CA_3C-7A-28A	7	0
	28	0
	3	0
CA_3C-7C-28A	7	0
_	28	0
	3	0
CA_3A-7A-38A	7	0
	38	0.2
	3	0
CA_3A-8A-40A	8	0
	40	0
	3	0.2
CA_3A-19A-42A	19	0
	42	0.5
	3	0.3
CA_3A-19A-42C	<u>3</u> 19	0.2
CA_3A-19A-42C	42	
		0.5
CA 2A 20A 40A	3	0
CA_3A-28A-40A	28	0
	40	0
04 04 004 400	3	0
CA_3A-28A-40C	3 28	0
CA_3A-28A-40C	3 28 40	0 0 0
	3 28 40 3	0 0 0 0 0.5
CA_3A-28A-40C	3 28 40 3 41	0 0 0 0.5 0 ⁵ /0.5 ⁶
	3 28 40 3 41 42	0 0 0 0.5 0 ⁵ /0.5 ⁶ 0.5
CA_3A-41A-42A ⁷	3 28 40 3 41 42 4	0 0 0 0.5 0 ⁵ /0.5 ⁶ 0.5
	3 28 40 3 41 42 4 5	0 0 0 0.5 0 ⁵ /0.5 ⁶ 0.5 0
CA_3A-41A-42A ⁷	3 28 40 3 41 42 4	0 0 0 0.5 0 ⁵ /0.5 ⁶ 0.5 0 0.5
CA_3A-41A-42A ⁷ CA_4A-5A-12A	3 28 40 3 41 42 4 5	0 0 0 0.5 0 ⁵ /0.5 ⁶ 0.5 0
CA_3A-41A-42A ⁷	3 28 40 3 41 42 4 5	0 0 0 0.5 0 ⁵ /0.5 ⁶ 0.5 0 0.5

	4	0
CA_4A-5A-13A	5	0
CA_4A-3A-13A	13	0
	4	0
CA_4A-5A-29A —	5	0
	4	0.4
CA 4A 5A 30A		
CA_4A-5A-30A		0
	30	0.5
00 40 40 50 000	4	0.4
CA_4A-4A-5A-30A	5	0
	30	0.5
	4	0.5
CA_4A-7A-12A	7	0.5
	12	0.5
	4	0.4
CA_4A-12A-30A	12	0.5
	30	0.5
	4	0.4
CA_4A-4A-12A-30A	12	0.5
	30	0.5
CA 4A 20A 20A	4	0.4
CA_4A-29A-30A	30	0.5
0.4.4.4.4.00.4.00.4	4	0.4
CA_4A-4A-29A-30A	30	0.5
	7	0
CA_7A-8A-20A	8	0.2
_	20	[0.2]
	7	0
CA_7A-20A-38A	20	0
	38	0.2
	19	0
CA_19A-21A-42A	21	0
	42	0.5
	19	0
CA_19A-21A-42C	21	0
5/13/A-21/A-420	42	0.5
NOTE 1. The above additi		nulicable for the FLITDA

- NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.
- NOTE 2: The above additional tolerances also apply in intra-band and nonaggregated operation for the supported E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.
- NOTE 3: Unless otherwise specified, in case the UE supports more than one of the above 3DL inter-band carrier aggregation configurations and a E-UTRA operating band belongs to more than one 3DL inter-band carrier aggregation configurations then:
 - When the E-UTRA operating band frequency range is ≤ 1GHz and the tolerances are the same, the value applies to the band. If the tolerances are different, the applicable additional 3DL tolerance is FFS. In case there is a harmonic relation between low band UL and high band DL, then the maximum tolerance among the different supported 3DL carrier aggregation configurations involving such band shall be applied
 - When the E-UTRA operating band frequency range is >1GHz, the applicable additional 3DL tolerance shall be the maximum tolerance above that applies for that operating band among the supported 3DL CA configurations.
- NOTE 4: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.
- NOTE 5: The requirement is specified for the frequency range of 2545-2690MHz.
- NOTE 6: The requirement is specified for the frequency range of 2496-2545MHz.
- NOTE 7: Applicable for UE supporting inter-band carrier aggregation without simultaneous Rx/Tx among TDD bands.

Table 7.3.1-1C: ΔR_{IB,c} (four bands)

Inter-band CA	E LITDA Donal	AD LUDI
	E-UTRA Band	ΔR _{IB,c} [dB]
Configuration		0
<u> </u>	1	0
CA_1A-3A-5A-40A	3	0
_	5	0
	40	0
	1	0
CA_1A-3A-7A-8A	3	0
	7	0
	8	0.2
	1	0
CA 4A 2A 7A 20A	3	0
CA_1A-3A-7A-28A	7	0
	28	0.2
	1	0
	3	0
CA_1A-3A-7C-28A —	7	0
	28	0.2
	1	0.2
 		
CA_1A-3A-8A-40A —	3	0
	8	0
	40	0
	1	0.2
CA_1A-3A-19A-42A	3	0.2
0/(_/// 0// 10// 12//	19	0
	42	0.5
	1	0.2
CA 4A 2A 40A 42C	3	0.2
CA_1A-3A-19A-42C	19	0
	42	0.5
	1	0
	19	0
CA_1A-19A-21A-42A —	21	0
	42	0.5
	1	0
 	1 19	0
CA_1A-19A-21A-42C —		
<u> </u>	21	0
	42	0.5
	2	0.3
CA_2A-4A-5A-12A	4	0.3
	5	0.5
	12	0.5
	2	0.3
CA_2A-4A-5A-29A	4	0.3
	5	0
	2	0.4
00.00.40.50.000	4	0.4
CA_2A-4A-5A-30A	5	0
	30	0.5
	2	0.3
-	4	0.3
CA_2A-4A-7A-12A —		0.5
 		0.5
 		
	2	0.4
CA_2A-4A-12A-30A	4	0.4
	12	0.5
	30	0.5
	2	0.4
CA_2A-4A-29A-30A	4	0.4
	30	0.5
NOTE 1: The above addit	ional talaranasa ara anly any	oliooble for the E LITPA

NOTE 1: The above additional tolerances are only applicable for the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

NOTE 2: The above additional tolerances also apply in intra-band and non-

aggregated operation for the supported E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

NOTE 3: Tolerances for a UE supporting multiple 4DL inter-band CA configurations

NOTE 3: Tolerances for a UE supporting multiple 4DL inter-band CA configurations are FFS.

NOTE 4: The above additional tolerances applicable for the E-UTRA operating bands that belong to the supported highest order inter-band carrier aggregation configuration, also applies to the same E-UTRA operating bands that belong to a supported lower order CA configuration.

NOTE: The above additional tolerances do not apply to supported UTRA operating bands with frequency range below 1 GHz that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations when such bands are belonging only to band combination(s) where one band is <1GHz and other bands are >1.7GHz and there is no harmonic relationship between the low band UL and high band DL. Otherwise the above additional tolerances also apply to supported UTRA operating bands that correspond to the E-UTRA operating bands that belong to the supported inter-band carrier aggregation configurations.

Table 7.3.1-2: Uplink configuration for reference sensitivity

E-UTRA Band / Channel bandwidth / N _{RB} / Duplex mode								
E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode	
1			25	50	75	100	FDD	
2	6	15	25	50	50 ¹	50 ¹	FDD	
3	6	15	25	50	50 ¹	50 ¹	FDD	
4	6	15	25	50	75	100	FDD	
5	6	15	25	25 ¹			FDD	
6			25	25 ¹			FDD	
7			25	50	75	75 ¹	FDD	
8	6	15	25	25 ¹			FDD	
9			25	50	50 ¹	50 ¹	FDD	
10			25	50	75	100	FDD	
11			25	25 ¹			FDD	
12	6	15	20 ¹	20 ¹			FDD	
13			20 ¹	20 ¹			FDD	
14			15 ¹	15 ¹			FDD	
17			20 ¹	20 ¹			FDD	
18			25	25 ¹	25 ¹		FDD	
19			25	25 ¹	25 ¹		FDD	
20			25	20 ¹	20 ³	20 ³	FDD	
21			25	25 ¹	25 ¹		FDD	
22			25	50	50 ¹	50 ¹	FDD	
23	6	15	25	50	75	100	FDD	
24			25	50			FDD	
25	6	15	25	50	50 ¹	50 ¹	FDD	
26	6	15	25	25 ¹	25 ¹		FDD	
27	6	15	25	25 ¹			FDD	
28		15	25	25 ¹	25 ¹	25 ¹	FDD	
30			25	25 ¹			FDD	
31	6	5 ⁴	5 ⁴				FDD	
33			25	50	75	100	TDD	
34			25	50	75		TDD	
35	6	15	25	50	75	100	TDD	
36	6	15	25	50	75	100	TDD	
37		10	25	50	75	100	TDD	
38			25	50	75	100	TDD	
39			25	50	75	100	TDD	
40			25	50	75	100	TDD	
41			25	50	75	100	TDD	
42			25	50	75	100	TDD	
43			25	50	75	100	TDD	
44		15	25	50	75	100	TDD	
45		13	25	50	75	100	TDD	
			23	30	7.5	100	טטו	
65	6	15	25	50	75	100	FDD	
66	6	15	25	50	75 75	100	FDD	
68	U	13	25	25 ¹	25 ¹	100	FDD	
NOTE 1: 1	rofore to th	o III. rosc				closo as r		

NOTE 1: ¹ refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 2:	For the UE which supports both Band 11 and Band 21 the uplink
	configuration for reference sensitivity is FFS.
NOTE 3:	³ refers to Band 20; in the case of 15MHz channel bandwidth, the UL
	resource blocks shall be located at RB _{start} 11 and in the case of 20MHz
	channel bandwidth, the UL resource blocks shall be located at RB _{start} 16
NOTE 4:	⁴ refers to Band 31; in the case of 3 MHz channel bandwidth, the UL
	resource blocks shall be located at RB _{start} 9 and in the case of 5 MHz

resource blocks shall be located at RB_{start} 9 and in the case of 5 MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 10.

Unless given by Table 7.3.1-3, the minimum requirements specified in Tables 7.3.1-1, 7.3.1-1a and 7.3.1-2 shall be verified with the network signalling value NS_01 (Table 6.2.4-1) configured.

Table 7.3.1-3: Network signalling value for reference sensitivity

E-UTRA	Network
Band	Signalling
	value
2	NS_03
4	NS_03
10	NS_03
12	NS_06
13	NS_06
14	NS_06
17	NS_06
19	NS_08
21	NS_09
23	NS_03
25	NS_03
30	NS_21
66	NS_03

7.3.1A Minimum requirements (QPSK) for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1, Table 7.3.1-1a and Table 7.3.1-2. The reference sensitivity is defined to be met with all downlink component carriers active and one of the uplink carriers active. The uplink resource blocks shall be located as close as possible to the primary downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1). The primary downlink operating band is the downlink band of the active uplink operating band. The UE shall meet the requirements specified in subclause 7.3.1 with the following exceptions.

For the bands supporting 4 antenna ports which are in Table 7.3.1-1a, the minimum requirements for reference sensitivity in the reference sensitivity exception tables shall be modified by the amount given in $\Delta R_{IB,4R}$ in Table 7.3.1-1a for the applicable E-UTRA bands unless otherwise specified.

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0a, exceptions to the aforementioned requirements are allowed when the uplink is active in a lower-frequency band and is within a specified frequency range such that transmitter harmonics fall within the downlink transmission bandwidth assigned in a higher band as noted in Table 7.3.1A-0a. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0a and Table 7.3.1A-0b.

Table 7.3.1A-0a: Reference sensitivity for carrier aggregation QPSK P_{REFSENS, CA} (exceptions due to harmonic issue)

		CI	hannel bar	dwidth				
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode
	1			N/A	N/A	N/A	N/A	
00 10 00 70 004	3			N/A	N/A	N/A	N/A	
CA_1A-3A-7A-8A ⁴	7				N/A	N/A	N/A	FDD
	8			N/A	N/A			Ī
	1			-100	-97	-95.2	-94	
	3			-97	-94	-92.2	-91	1
CA_1A-3A-7A-8A ^{4,5,6}	7 ²¹			0.	-87.4	-87	-86.7	FDD
	8			-96.8	-93.8	01	00.7	1
	1 ²¹			-89.8	-89.4	-89	-88.7	
	-			-09.0				}
CA_1A-3A-7A-28A ^{5,6}	3				-94	-92.2	-91	FDD
	7 28				-95 -95.3	-93.2 -93.5	-92 -90.8	
				N1/A				
0	1			N/A	N/A	N/A	N/A	
CA_1A-3A-8A ⁴	3			N/A	N/A	N/A	N/A	FDD
	8		N/A	N/A	N/A			
	1			N/A	N/A	N/A	N/A	
CA_1A-3A-8A-40A ⁴	3			N/A	N/A	N/A	N/A	FDD
CA_1A-3A-6A-4UA	8		N/A	N/A	N/A			1
	40			N/A	N/A	N/A	N/A	TDD
	1			-99.8	-96.8	-95	-93.8	
CA_1A-3A-19A-42A ^{9,10}	3			-96.8	-93.8	-92	-90.8	FDD
CA_1A-3A-19A-42A	19			-100	-97	-95.2		
	42 ²¹			-71.7	-71.7	-71.7	-71.7	TDD
	1			-99.8	-96.8	-95	-93.8	
CA_1A-3A-19A-42A ¹¹	3 19			-96.8 -100	-93.8 -97	-92 -95.2	-90.8	FDD
	42 ²¹			-97.1	-91.7	-93.2	-92.5	TDD
	121			-89.8	-89.4	-89	-88.7	100
CA_1A-3A-28A	3			-97	-94	-92.2	-91	FDD
OA_1A-3A-20A	28			-98.3	-95.3	-93.5	-90.8	100
	1			-96.3 -99.8	-95.3 -96.8	-95	-93.8	
CA_1A-3A-42A ^{9,10}	3			-96.8	-93.8	-93 -92	-90.8	FDD
ON_INCORCIZER	42 ²¹			-71.7	-71.7	-71.7	-71.7	TDD
	1			-99.8	-96.8	-95	-93.8	
CA_1A-3A-42A ¹¹	3			-96.8	-93.8	-92	-90.8	FDD
	42 ²¹			-97.1	-94.7	-93.2	-92.5	TDD
	1			-100	-97	-95.2	-94	
CA_1A-7A-8A ^{5,6}	7 ²¹				-87.4	-87	-86.7	FDD
	8			-96.8	-93.8			
	1 ²¹			-89.8	-89.4	-89	-88.7	
CA_1A-7A-28A ^{5,6}	7				-95	-93.2	-92	FDD
- -	28			-98.3	-95.3	-93.5	-90.8	1
	1			N/A	N/A	N/A	N/A	
CA_1A-18A-28A ¹⁴	18			N/A	N/A	N/A	14//3	FDD
OA_1A-10A-20A						IN/A		טט ו
	28			N/A	N/A	B.1/A	N1/A	
	1			N/A	N/A	N/A	N/A	<u></u> _
CA_1A-19A-28A ¹⁴	19			N/A	N/A	N/A		FDD
	28			N/A	N/A			
CA_1A-28A ^{5,6,14}	1 ²¹				-88.7	FDD		
UA_1A-20A-1-1	28			-98.3	-95.3	-93.5	-90.8	-00
CA 2A-4A-12A ^{5,6}	2			-97.7	-94.7	-92.9	-91.7	FDD

	4			-90	-89.5	-89	-88.5	
	12			-96.5	-93.5			
	2			-97.7	-94.7	-92.9	-91.7	
CA_2A-4A-5A-12A ^{5,6}	4			-90	-89.5	-89	-88.5	FDD
ON_2/\ 4/\ ON\ 12/\	5			-97.5	-94.5			100
	12			-96.5	-93.5	20.0	04.7	
	2			-97.7	-94.7	-92.9	-91.7	<u> </u>
CA_2A-4A-7A-12A ^{5,6}	4			-90	-89.5	-89	-88.5	FDD
_	7			-97.5	-94.5	-92.7	-91.5	<u> </u>
	12			-96.5	-93.5			
	2			-97.6	-94.6	-92.8	-91.6	<u> </u>
CA_2A-4A-12A-30A ^{5,6}	4			-90	-89.5	-89	-88.5	FDD
o	12			-96.5	-93.5			
	30			-98.5	-95.5			
	3			N/A	N/A	N/A	N/A	
CA_3A-7A-8A ⁴	7				N/A	N/A	N/A	FDD
	8			N/A	N/A]
	3			-97	-94	-92.2	-91	
CA_3A-7A-8A ^{4,5,6}	7 ²¹			-	-87.4	-87	-86.7	FDD
5.1_5.111. G.1	8			-96.8	-93.8	0.	00	
	3			N/A	N/A	N/A	N/A	
CA_3A-8A ⁴			NI/A			IN/A	IN/A	FDD
	8		N/A	N/A	N/A	N1/A	N1/A	
	3			N/A	N/A	N/A	N/A	FDD
CA_3A-8A-40A ⁴	8		N/A	N/A	N/A			
	40			N/A	N/A	N/A	N/A	TDD
	3			-96.8	-93.8	-92	-90.8	FDD
CA_3A-19A-42A ^{9,10}	19			-100	-97	-95.2		
	42 ²¹			-71.7	-71.7	-71.7	-71.7	TDD
CA_3A-19A-42A ¹¹	3 19			-96.8 -100	-93.8 -97	-92 -95.2	-90.8	FDD TDD
0A_0A-19A-42A	42 ²¹			-97.1	-94.7	-93.2	-92.5	
	3			-97	-94	-92.2	-91	
CA_3A-28A-40A ^{15,16}	28			-60.7	-60.7	-60.7	-60.7	FDD
	40			-100	-97	-95.2	-94	TDD
04 04 04 41213	3 ²¹			-86.9	-86.4	-86	-85.6	
CA_3A-31A ^{12,13}	31		-95.5	-93.3				FDD
	3			-96.8	-93.8	-92	-90.8	FDD
CA_3A-42A ^{9,10}	42 ²¹			-71.7	-71.7	-71.7	-71.7	TDD
	3			-96.8	-93.8	-92	-90.8	FDD
CA_3A-42A ¹¹	42 ²¹			-97.1	-94.7	-93.2	-92.5	TDD
	42			-90	-89.5	-89	-88.5	טטו
CA_4A-5A-12A ^{5,6}	5			-90 -97.5	-94.5	-09	-00.0	FDD
5/1_// 5// 12//	12			-96.5	-93.5			, 55
	4			-90	-89.5	-89	-88.5	
CA_4A-7A-12A ^{5,6}	7			-97.5	-94.5			FDD
	12			-96.5	-93.5			
CA 4A 40A56	4	-89.2	-89.2	-90	-89.5	-89	-88.5	EDD
CA_4A-12A ^{5,6}	12		-98.2	-96.5	-93.5			FDD
	4			-90	-89.5	-89	-88.5	
CA_4A-12A-30A ^{5,6}	12			-96.5	-93.5			FDD
	30		-98.5	-95.5			- -	
	4			-90.5	-89.5			_
CA_4A-17A ^{5,6}	17			-96.5	-93.5			FDD
OA 44 00 4 5 6	4			-89.8	-89.4	-89	-88.7	F0.
CA_4A-28A ^{5,6}	28			-98.3	-95.3	-93.5	-90.8	FDD
CA_5A-38A ¹⁹	5			N/A	N/A			FDD
UA_DA-SOA."	38			N/A	N/A	N/A	N/A	TDD
CA_7A-8A ^{5,6}	7 ²¹				-87.4	-87	-86.7	FDD
<u> </u>	8		-99	-96.8	-93.8		1	. 55

	7 ²¹				-87.4	-87	-86.7	
CA_7A-8A-20A ^{5,6}	8		-99	-96.8	-93.8			FDD
	20			[-96.8]	[-93.8]			
	7				N/A	N/A	N/A	FDD
CA_7A-20A-38A ¹⁹	20			N/A	N/A	N/A	N/A	FDD
	38			N/A	N/A	N/A	N/A	TDD
CA_8A-41A ⁸	8	N/A	N/A	N/A	N/A			FDD
CA_6A-41A	41				N/A	N/A	N/A	TDD
CA 9A 42A1213	8	-102	-99	-96.8	-93.8			FDD
CA_8A-42A ^{12,13}	42 ²¹			-84.8	-84.7	-84.6	-84.5	TDD
CA 20A-38A ¹⁹	20			N/A	N/A	N/A	N/A	FDD
CA_20A-36A	38			N/A	N/A	N/A	N/A	TDD
CA_20A-40A ^{15,16}	20 ²¹			-60.7	-60.7	-60.7	-60.7	FDD
CA_20A-40A	40			-100	-97	-95.2	-94	TDD
CA_20A-42A ^{12,13} ,	20			-97	-94	-91.2	-90	FDD
CA_20A-42A-42A ^{12,13}	42 ²¹			-84.8	-84.7	-84.6	-84.5	TDD
CA_26A-41A ^{8, 19}	26			N/A	N/A	N/A		FDD
CA_26A-41A ³ , 13	41			N/A	N/A	N/A	N/A	TDD
CA_28A-40A ^{15,16}	28	· · · · · · · · · · · · · · · · · · ·		-60.7	-60.7	-60.7	-60.7	FDD
CA_26A-40A ^{16,16}	40			-100	-97	-95.2	-94	TDD
CA_28A-42A ^{17,18}	28			-98.3	-95.3	-93.5	-92.3	FDD
CA_26A-42A**	42 ²¹			-85.7	-85.4	-85.1	-84.9	TDD

- NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: The signal power is specified per port
- NOTE 4: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply unless otherwise specified).
- NOTE 5: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of a high band.
- NOTE 6: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that $f_{UL}^{LB} = \left \lfloor f_{DL}^{HB} \middle/ 0.3 \right \rfloor 0.1 \text{ in MHz and } F_{UL_low}^{LB} + BW_{Channel}^{LB} \middle/ 2 \leq f_{UL}^{LB} \leq F_{UL_high}^{LB} BW_{Channel}^{LB} \middle/ 2 \text{ with } f_{DL}^{HB} \text{ the carrier frequency of a high band in MHz and } BW_{Channel}^{LB} \text{ the channel bandwidth configured in the low band.}$
- NOTE 7: Void
- NOTE 8: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).
- NOTE 9: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band and a range ΔF_{HD} above and below the edge of this downlink transmission bandwidth. The value ΔF_{HD} depends on the E-UTRA configuration: ΔF_{HD} = 10 MHz for CA_3A-42A, CA_1A-3A-42A, CA_3A-19A-42A, and CA_1A-3A-19A-42A.
- NOTE 10: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \left \lfloor f_{DL}^{HB} / 0.2 \right \rfloor 0.1$ in MHz and $F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \le f_{UL_high}^{LB} BW_{Channel}^{LB} / 2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.
- NOTE 11: The requirements are only applicable to channel bandwidths with a carrier frequency at $\pm \left(20 + BW_{Channel}^{HB} / 2\right) \text{ MHz offset from } 2f_{UL}^{LB} \text{ in the victim (higher band) with } \\ F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL_high}^{LB} BW_{Channel}^{LB} / 2 \text{ , where } BW_{Channel}^{LB} \text{ and } BW_{Channel}^{HB} \text{ are the channel bandwidths configured in the aggressor (lower) and victim (higher) bands in MHz, respectively.}$
- NOTE 12: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 4th transmitter harmonic is within the downlink transmission bandwidth of a high band.
- NOTE 13: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that $f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} = \left\lfloor f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} / 0.4 \right\rfloor 0.1 \, \text{in MHz and} \ F_{\scriptscriptstyle UL_low}^{\scriptscriptstyle LB} + BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \le f_{\scriptscriptstyle UL_high}^{\scriptscriptstyle LB} BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \, \text{ with } f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} \, \text{ the carrier frequency of a high band in MHz and} \ BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} \, \text{ the channel bandwidth configured in the low band.}$
- NOTE 14: For the UE that supports CA_1A-18A-28A or CA_1A-19A-28A, no requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference

- sensitivity should only be verified when this is not the case (the requirements specified in clause 7.3.1 apply).
- NOTE 15: These requirements apply when there is at least one individual RE within the downlink transmission bandwidth of the victim (lower) band for which the 3rd harmonic is within the uplink transmission bandwidth or the uplink adjacent channel's transmission bandwidth of an aggressor (higher) band.
- NOTE 16: The requirements should be verified for UL EARFCN of the aggressor (higher) band (superscript HB) such that $f_{DL}^{LB} = \left \lfloor f_{UL}^{HB} / 0.3 \right \rfloor 0.1$ in MHz and $F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \le f_{UL}^{LB} \le F_{UL_high}^{LB} BW_{Channel}^{LB} / 2$ with f_{DL}^{LB} the carrier frequency in the victim (lower) band and $BW_{Channel}^{HB}$ the channel bandwidth configured in the bigher hand.
- NOTE 17: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 5th transmitter harmonic is within the downlink transmission bandwidth of a high band.
- NOTE 18: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that $f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} = \left\lfloor f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} / 0.5 \right\rfloor 0.1 \, \text{in MHz and} \ F_{\scriptscriptstyle UL_low}^{\scriptscriptstyle LB} + BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \le f_{\scriptscriptstyle UL_high}^{\scriptscriptstyle LB} BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \, \text{ with } f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} \, \text{ the carrier}$ frequency of a high band in MHz and $BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB}$ the channel bandwidth configured in the low band.
- NOTE 19: No requirements apply for the case that there is at least one individual RE within the uplink transmission bandwidth of the relative higher band and when the frequency range of relative higher band's uplink channel bandwidth or uplink 1st adjacent channel bandwidth is fully or partially overlapped with the 3 times of the frequency range of the relative lower band's downlink channel bandwidth. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).
- NOTE 20: Void.
- NOTE 21: Applicable for the operations with 2 or 4 antenna ports supported in the band with carrier aggregation configured.

Table 7.3.1A-0b: Uplink configuration for the low band (exceptions due to harmonic issue)

E-UTRA Ba	nd / Chan	nel band	width of t	he high b	and / N _{RB}	/ Duplex	mode	
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duple x mode
CA_1A-3A-7A-8A	8				16	25	25	FDD
CA_1A-3A-7A-28A	28				16	25	25	FDD
CA_1A-3A-19A-42A	3			12	25	36	50	FDD
CA_1A-3A-28A	28			8	16	25	25	FDD
CA_1A-3A-42A	3			12	25	36	50	FDD
CA_1A-7A-8A	8				16	25	25	FDD
CA_1A-7A-28A	28			8	16	25	25	FDD
CA_1A-28A	28			8	16	25	25	FDD
CA_2A-4A-12A	12			8	16	20	20	FDD
CA_2A-4A-5A-12A	12			8	16	20	20	FDD
CA_2A-4A-7A-12A	12			8	16	20	20	FDD
CA_2A-4A-12A-30A	12			8	16	20	20	FDD
CA_3A-7A-8A	8				16	25	25	FDD
CA_3A-19A-42A	3			12	25	36	50	FDD
CA_3A-28A-40A	40			25	50	75	100	TDD
CA_3A-31A	31			5	5	5	5	FDD
CA_3A-42A	3			12	25	36	50	FDD
CA_4A-5A-12A	12			8	16	20	20	FDD
CA_4A-7A-12A	12			8	16	20	20	FDD
CA_4A-12A	12	2	5	8	16	20	20	FDD
CA_4A-12A-30A	12			8	16	20	20	FDD
CA_4A-17A	17			8	16			FDD
CA_4A-28A	28			[8]	[16]	[25]	[25]	FDD
CA_7A-8A	8				16	25	25	FDD
CA_7A-8A-20A	8				16	25	25	FDD
CA_8A-42A	8			8	16	25	25	FDD
CA_20A-40A ³	40			25	50	75	100	TDD
CA_20A-42A, CA_20A-42A-42A	20			8	16	25	25	FDD
CA_28A-40A	40			25	50	75	100	TDD
CA_28A-42A	28			5	10	15	20	FDD

NOTE 1: refers to the UL resource blocks, which shall be centred within the transmission bandwidth configuration for the channel bandwidth.

NOTE 2: the UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.1-2 for the uplink bandwidth in which case the allocation according to Table 7.3.1-2 applies.

NOTE 3: ³ refers to the UL resource blocks shall be located between 2373-2400MHz.

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0bA, exceptions are allowed when the uplink is active within a specified frequency range as noted in Table 7.3.1A-0bA. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0bA and Table 7.3.1A-0bB.

Table 7.3.1A-0bA: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions for two bands due to close proximity of UL to DL channel)

			Channel b	andwidth				
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode
CA 4A 2A4	1			-100	-97	-95.2	-94	רככ
CA_1A-3A ⁴	3 ⁹			-94	-91.5	-90	-89	FDD
CA 4A 2A5	1			-100	-97	-95.2	-94	FDD
CA_1A-3A ⁵	3			-97	-94	-92.2	-91	FUU
CA 4A 2C4	1			-100	-97	-95.2	-94	FDD
CA_1A-3C ⁴	3 ⁹			-94	-91.5	-90	-89	
CA 4A 2C5	1			-100	-97	-95.2	-94	FDD
CA_1A-3C ⁵	3			-97	-94	-92.2	-91	FDD
CA 40A 20A6	18			-100	-97	-95.2		FDD
CA_18A-28A ⁶	28			-94	-92.5			רטט
CA 40A 20A7	19			-100	-97	-95.2		FDD
CA_19A-28A ⁷	28			-94	-92			רטט

- NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: The signal power is specified per port
- NOTE 4: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in Band 3, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 5: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz. For each channel bandwidth in Band 3, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 6: These requirements apply when the uplink is active in Band 18 and the downlink channels in Band 28 are confined within the restricted frequency range specified for this CA configuration (Table 5.5A-2). For each channel bandwidth in Band 28, the requirement applies regardless of channel bandwidth in Band 18.
- NOTE 7: These requirements apply when the uplink is active in Band 19 and the downlink channels in Band 28 are allocated at the middle of the restricted frequency range specified for this CA configuration (Table 5.5A-2). For each channel bandwidth in Band 28, the requirement applies regardless of channel bandwidth in Band 19.
- NOTE 8: Void
- NOTE 9: Applicable for the operations with 2 or 4 antenna ports supported in the band with carrier aggregation configured.

Table 7.3.1A-0bB: Uplink configuration for the uplink band (exceptions for two bands due to close proximity of UL to DL channel)

E-UTI	E-UTRA Band / Channel bandwidth of the affected DL band / NRB / Duplex mode										
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex mode			
CA_1A-3A ^{1, 2}	1			25	25	25	25	FDD			
CA_1A-3A ^{1, 3}	1			25	45	45	45	FDD			
CA_1A-3C ^{1, 2}	1			25	25	25	25	FDD			
CA_1A-3C ^{1, 3}	1			25	45	45	45	FDD			
CA_18A-28A ⁴	18			18	18			FDD			
CA_19A-28A ⁴	19			18	18			FDD			

- NOTE 1: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 3 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1) in the uplink channel in Band 1.
- NOTE 2: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz
- NOTE 3: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz.
- NOTE 4: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 28 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0bC, exceptions are allowed when the uplink is active within a specified frequency range as noted in Table 7.3.1A-0bC. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0bC and Table 7.3.1A-0bD.

Table 7.3.1A-0bC: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions for three bands due to close proximity of UL to DL channel)

Channel bandwidth									
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode	
	1			-100	-97	-95.2	-94		
CA_1A-3A-5A ⁴	3 ¹²			-94	-91.5	-90	-89	FDD	
	5			-98	-95				
	1			-100	-97	-95.2	-94		
CA_1A-3A-5A ⁵	3			-97	-94	-92.2	-91	FDD	
	5			-98	-95				
	1			-100	-97	-95.2	-94		
CA_1A-3A-7A ⁹	3 ¹²			-94	-91.5	-90	-89	FDD	
_	7				-95	-93.2	-92		
	1			-100	-97	-95.2	-94		
CA_1A-3A-7A ¹⁰	3			-97	-94	-92.2	-91	FDD	
	7				-95	-93.2	-92		
	1			-100	-97	-95.2	-94		
CA_1A-3A-7C ⁹	3 ¹²				-91.5	-90	-89	FDD	
0/(_/// 0/// 0	7				-95	-93.2	-92	, 55	
	1			-100	-97	-95.2	-94		
CA_1A-3A-7C ¹⁰	3			100	-94	-92.2	-91	FDD	
OA_1A-3A-10	7				-95	-93.2	-92	100	
	1			-100	-97	-95.2	-94		
CA_1A-3A-8A ⁴	3 ¹²			-94	-91.5	-90	-89	FDD	
CA_IA-SA-SA	8		-99.2	-97	-91.5	-90	-03	100	
	1		-99.2	-100	-94 -97	-95.2	-94		
CA 4A 2A 0A5	3			-97	-97 -94	-93.2 -92.2	-9 4 -91	FDD	
CA_1A-3A-8A ⁵	8		-99.2	-97 -97	-94	JZ.Z	31	. 55	
	1		-99.2	-100	-94 -97	-95.2	-94		
CA 4A 2A 40A4	3 ¹²								
CA_1A-3A-19A ⁴	-			-94	-91.5	-90	-89	FDD	
	19			-100	-97	-95.2	0.4		
04 44 04 4045	1			-100	-97	-95.2	-94		
CA_1A-3A-19A ⁵	3			-97	-94	-92.2	-91	FDD	
	19			-100	-97	-95.2	0.4		
	1			-100	-97	-95.2	-94		
CA_1A-3A-20A ⁴	312			-94	-91.5	-90	-89	FDD	
	20			-97	-94	-91.2	-90		
_	1			-100	-97	-95.2	-94		
CA_1A-3A-20A ⁵	3			-97	-94	-92.2	-91	FDD	
	20			-97	-94	-91.2	-90		
	1			-100	-97	-95.2	-94		
CA_1A-3A-26A ⁴	312			-94	-91.5	-90	-89	FDD	
	26			-97.5 ⁷	-94.5 ⁷				
	1			-100	-97	-95.2	-94		
CA_1A-3A-26A ⁵	3			-97	-94	-92.2	-91	FDD	
	26			-97.5 ⁷	-94.5 ⁷				
	1			-100	-97	-95.2	-94		
CA_1A-3A-28A ⁴	312	<u></u>		-94	-91.5	-90	-89		
	28			-98.3	-95.3	-93.5	-90.8		
	1			-100	-97	-95.2	-94		
CA_1A-3A-28A ⁵	<u> </u>		-97	-94	-92.2	-91	FDD		
	28			-98.3	-95.3	-93.5	-90.8		

	1		-100	-97	-95.2	-94	FDD
CA_1A-3A-40A ⁴	312		-94	-91.5	-90	-89	רטט
	40		[-93.4]	-91.3	-90	-88.9	TDD
	1		-100	-97	-95.2	-94	FDD
CA_1A-3A-40A ⁵	3		-97	-94	-92.2	-91	רטט
	40		[-93.4]	-91.3	-90	-88.9	TDD
	1		-99.8	-96.8	-95	-93.8	FDD
CA_1A-3A-42A ⁴	312		-93.8	-91.3	-89.8	-88.8	FDD
	42		-98.5	-95.5	-93.7	-92.5	TDD
	1		-99.8	-96.8	-95	-93.8	FDD
CA_1A-3A-42A ⁵	3		-96.8	-93.8	-92	-90.8	FDD
	42		-98.5	-95.5	-93.7	-92.5	TDD
	1		-99.8	-96.8	-95	-93.8	FDD
CA_1A-3A-42C4	3 ¹²		-93.8	-91.3	-89.8	-88.8	רטט
	42		-98.5	-95.5	-93.7	-92.5	TDD
	1		-99.8	-96.8	-95	-93.8	FDD
CA_1A-3A-42C ⁵	3		-96.8	-93.8	-92	-90.8	FDD
	42		-98.5	-95.5	-93.7	-92.5	TDD
	1		-100	-97	-95.2	-94	
CA_1A-18A-28A ⁶	18		-100	-97	-95.2		FDD
	28		-94	-92.5			
	1		-100	-97	-95.2	-94	
CA_1A-19A-28A8	19		-100	-97	-95.2		FDD
	28		-94	-92			

- NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: The signal power is specified per port
- NOTE 4: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in Band 3 and Band 5 or Band 8 or Band 19 or Band 20 or Band 26 or Band 28 or Band 42, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 5: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz. For each channel bandwidth in Band 3 and Band 5 or Band 8 or Band 19 or Band 20 or Band 26 or Band 28 or Band 42, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 6: These requirements apply when the uplink is active in Band 18 and the downlink channels in Band 28 are confined within the restricted frequency range specified for this CA configuration (Table 5.5A-2). For each channel bandwidth in Band 28, the requirement applies regardless of channel bandwidth in Band 18
- NOTE 7: ⁷ indicates that the requirement is modified by -0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.
- NOTE 8: These requirements apply when the uplink is active in Band 19 and the downlink channels in Band 28 are allocated at the middle of the restricted frequency range specified for this CA configuration (Table 5.5A-2). For each channel bandwidth in Band 28, the requirement applies regardless of channel bandwidth in Band 19.
- NOTE 9: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in Band 3 and Band 7, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 10: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz. For each channel bandwidth in Band 3 and Band 7, the requirement applies regardless of channel bandwidth in Band 1.
- NOTE 11: Void
- NOTE 12: Applicable for the operations with 2 or 4 antenna ports supported in the band with carrier aggregation configured.

Table 7.3.1A-0bD: Uplink configuration for the uplink band (exceptions for three bands due to close proximity of UL to DL channel)

E-UTRA	E-UTRA Band / Channel bandwidth of the affected DL band / NRB / Duplex mode											
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex mode				
CA_1A-3A-5A ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-5A ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-3A-7A ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-7A ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-3A-7C ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-7C ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-3A-8A ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-8A ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-3A-19A ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-19A ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-3A-20A ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-20A ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-3A-26A ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-26A ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-3A-28A ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-28A ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-3A-40A ^{1,2}	1			25	25	25	25	FDD				
CA_1A-3A-40A ^{1,3}	1			25	45	45	45	FDD				
CA_1A-3A-42A ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-42A ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-3A-42C ^{1, 2}	1			25	25	25	25	FDD				
CA_1A-3A-42C ^{1, 3}	1			25	45	45	45	FDD				
CA_1A-18A-28A ⁴	18			18	18			FDD				
CA_1A-19A-28A ⁴	19			18	18			FDD				

NOTE 1: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 3 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1) in the uplink channel in Band 1.

NOTE 2: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz

NOTE 3: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz.

NOTE 4: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 28 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0bD1, exceptions are allowed when the uplink is active within a specified frequency range as noted in Table 7.3.1A-0bD1. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-0bD1 and Table 7.3.1A-0bD2.

Table 7.3.1A-0bD1: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions for four bands due to close proximity of UL to DL channel)

Channel bandwidth											
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode			
	1			-100	-97	-95.2	-94				
	3 ^{4,7}			-94	-91.5	-90	-89				
CA_1A-3A-5A-40A	3 ⁵			-97	-94	-92.2	-91	FDD			
	5			-98	-95						
	40				-91.9	-90.4	-89.4	TDD			
	1			-100	-97	-95.2	-94				
	3 ^{4,7}			-94	-91.5	-90	-89				
CA_1A-3A-7A-8A	3 ⁵			-97	-94	-92.2	-91	FDD			
_	7				-95	-93.2	-92				
	8			-96.8	-93.8						
	1			-100	-97	-95.2	-94				
	3 ^{4.7}				[-91.5]	[-90]	[-89]				
CA_1A-3A-7A-28A	3 ⁵				-94	-92.2	-91	FDD			
	7				-95	-93.2	-92				
	28				-95.3	-93.5	-90.8				
	1			-100	-97	-95.2	-94	FDD			
	3 ^{4,7}				[-91.5]	[-90]	[-89]				
CA_1A-3A-7C-28A	3 ⁵				-94	-92.2	-91				
	7				-95	-93.2	-92				
	28				-95.3	-93.5	-90.8				
	1			-100	-97	-95.2	-94				
	3 ^{4,7}			-94	-91.5	-90	-89	FDD			
CA_1A-3A-8A-40A	3 ⁵			-97	-94	-92.2	-91	רטט			
	8		-99.2	-97	-94						
	40			[-93.4]	-91.9	-90.4	-89.4	TDD			
	1			-99.8	-96.8	-95	-93.8				
	34,7			-93.8	-91.3	-89.8	-88.8	500			
CA_1A-3A-19A-42A	3 ⁵			-96.8	-93.8	-92	-90.8	FDD			
	19			-100	-97	-95.2					
	42			-98.5	-95.5	-93.7	-92.5	TDD			
	1			-99.8	-96.8	-95	-93.8				
	3 ^{4,7}			-93.8	-91.3	-89.8	-88.8				
CA_1A-3A-19A-42C	3 ⁵			-96.8	-93.8	-92	-90.8	FDD			
	19			-100	-97	-95.2					
	42			-98.5	-95.5	-93.7	-92.5	TDD			

NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

NOTE 3: The signal power is specified per port

NOTE 4: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz. For each channel bandwidth in the bands other than Band 1, the requirement applies regardless of channel bandwidth in Band 1.

NOTE 5: These requirements apply when the uplink is active in Band 1 and the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz. For each channel bandwidth in the bands other than Band 1, the requirement applies regardless of channel bandwidth in Band 1.

NOTE 6: Void

NOTE 7: Applicable for the operations with 2 or 4 antenna ports supported in the band with carrier aggregation configured.

Table 7.3.1A-0bD2: Uplink configuration for the low band (exceptions for four bands due to close proximity of UL to DL channel)

E-UTRA	E-UTRA Band / Channel bandwidth of the affected DL band / NRB / Duplex mode										
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex mode			
CA_1A-3A-5A-40A	1 ^{1,2}			25	25	25	25				
CA_1A-3A-7A-8A CA_1A-3A-7A-28A CA_1A-3A-7C-28A CA_1A-3A-8A-40A CA_1A-3A-19A-42A	1 ^{1,3}			25	45	45	45	FDD			
_	1 ^{1,2}			25	25	25	25	FDD			
CA_1A-3A-19A-42C	1 ^{1,3}			25	45	45	45	טטיז			

- NOTE 1: refers to the UL resource blocks shall be located as close as possible to the downlink channel in Band 3 but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1) in the uplink channel in Band 1.
- (Table 5.6-1) in the uplink channel in Band 1.

 NOTE 2: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is < 60 MHz
- NOTE 3: UL allocation when the separation between the lower edge of the uplink channel in Band 1 and the upper edge of the downlink channel in Band 3 is ≥ 60 MHz.

For the UE that supports any of the E-UTRA CA configurations given in Table 7.3.1A-0bE, exceptions are allowed when the uplink is active in the applicable active UL bands in Table 7.3.1A-0bE. For these exceptions, the UE shall meet the reference sensitivities specified in Table 7.3.1A-0bE and Table 7.3.1A-0bF.

Table 7.3.1A-0bE: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions due to cross band isolation issues of TDD and FDD bands)

	FUTD		(Channel ba	andwidth				Applicabl
EUTRA CA Configuration	EUTR A band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duple x mode	e active UL band
	1			-100	-97	-95.2	-94		
0.4.4.0.4.5.4.40.4	3			-97	-94	-92.2	-91	FDD	
CA_1A-3A-5A-40A	5			-98	-95				3
	40				-92.9	-91.3	-90.2	TDD	
	1 ¹²			-91.7	[-89.5]	[-87.9]	[-86.9]		
00 40 00 50 400	312			-94.2	-91.2	-89.5	-88.3	FDD	40
CA_1A-3A-5A-40A	5			-98	-95				40
	40				-97	-95.2	-94	TDD	
	1			-100	-97	-95.2	-94		
04 44 04 04 404	3			-97	-94	-92.2	-91	FDD	0
CA_1A-3A-8A-40A	8		-99.2	-97	-94				3
	40			-95.4	-92.9	-91.3	-90.2	TDD	
	1 ¹²			-91.7	[-89.5]	[-87.9]	[-86.9]		
04 44 04 04 404	312			-94.2	-91.2	-89.5	-88.3	FDD	40
CA_1A-3A-8A-40A	8		-99.2	-97	-94				40
	40			-100	-97	-95.2	-94	TDD	
	1			-100	-97	-95.2	-94	EDD	
CA_1A-3A-40A	3			-97	-94	-92.2	-91	FDD	3
	40			-100	-92.9	-91.3	-90.2	TDD	
	1 ¹²			-91.7	[-89.5]	[-87.9]	[-86.9]	EDD	
CA_1A-3A-40A	312			-94.2	-91.2	-89.5	-88.3	FDD	40
	40			-100	-97	-95.2	-94	TDD	
	1			-100	-97	-95.2	-94	EDD	
CA_1A-5A-40A	5			-98	-95			FDD	1
	40				-91.9	-90.4	-89.4	TDD	
	1 ¹²			-91.7	[-89.5]	[-87.9]	[-86.9]	EDD	
CA_1A-5A-40A	5			-98	-95			FDD	40
	40				-97	-95.2	-94	TDD	
	1			-100	-97	-95.2	-94	EDD	
CA_1A-8A-40A	8		-99.2	-97	-94			FDD	1
	40			[-93.4]	-91.9	-90.4	-89.4	TDD	
	1 ¹²			-91.7	[-89.5]	[-87.9]	[-86.9]	EDD	
CA_1A-8A-40A	8		-99.2	-97	-94			FDD	40
	40			-100	-97	-95.2	-94	TDD	
CA 1A 40A	1			-100	-97	-95.2	-94	FDD	1
CA_1A-40A	40			[-93.4]	-91.9	-90.4	-89.4	TDD	1
CA_1A-40A	1 ¹²			-91.7	[-89.5]	[-87.9]	[-86.9]	FDD	40
CA_1A-40A	40			-100	-97	-95.2	-94	TDD	40
	3			-97	-94	-92.2	-91	FDD	
CA_3A-5A-40A	5			-98	-95			טטו	3
	40				-92.9	-91.3	-90.2	TDD	
	312			-94.2	-91.2	-89.5	-88.3	FDD	
CA_3A-5A-40A	5			-98	-95			טטו	40
	40				-97	-95.2	-94	TDD	
	3			-97	-94	-92.2	-91	FDD	
CA_3A-7A-38A	7			[-93.8]	[-91.2]	[-89.7]	[-88.6]	רטט	3
	38			[-93.8]	[-91.2]	[-89.7]	[-88.6]	TDD	
CA_3A-8A-40A	3			-97	-94	-92.2	-91	FDD	3

	8	-99.2	-97	-94				
	40		-95.4	-92.9	-91.3	-90.2	TDD	
	312		-94.2	-91.2	-89.5	-88.3	ר	
CA_3A-8A-40A	8	-99.2	-97	-94			FDD	40
	40		-100	-97	-95.2	-94	TDD	
	3		-97	-94	-92.2	-91		
CA_3A-28A-40A	28		-98.5	-95.5	-93.7	-91	FDD	3
	40		-95.4	-92.9	-91.3	-90.2	TDD	
	3 ¹²		-94.2	-91.2	-89.5	-88.3		
CA_3A-28A-40A	28		-96.8	-94.1	-92.5	-89.8	FDD	40
	40		-100	-97	-95.2	-94	TDD	
	3		-97	-94	-92.2	-91		
CA_3A-28A-40A	28		-98.5	-95.5	-93.7	-91	FDD	28
	40		-95.1	-92.9	-91.4	-90.5	TDD	
	3		-97	-94	-92.2	-91		
CA_3A-28A-40C	28		-98.5	-95.5	-93.7	-91	FDD	3
0/1_0/\ 20/\ 100	40		-95.4	-92.9	-91.3	-90.2	TDD	J
	3		-97	-94	-92.2	-91	. 55	
CA_3A-28A-40C	28		-98.5	-94	-92.2	-91	FDD	28
OA_0A-20A-400	40		-96.5 -95.1	-93.5	-91.4	-90.5	TDD	20
	3 ¹²		-94.2	-92.9	-89.5	-88.3	100	
CA_3A-28A-40C	28		-94.2 -96.8	-91.2	-92.5	-89.8	FDD	40
CA_3A-20A-40C					-92.5 -95.2	-69.6 -94	TDD	40
	40		-100	-97				
CA_3A-40A	3		-97	-94	-92.2	-91		3
	40		-95.4	-92.9	-91.3	-90.2	FDD TDD TDD TDD TDD TDD TDD TDD TDD TDD	
CA_3A-40A	312		-94.2	-91.2	-89.5	-88.3	FDD TDD FDD	40
	40		-100	-97	-95.2	-94		
CA_3A-40C	3		-97	-94	-92.2	-91	FDD TDD FDD	3
	40		-95.4	-92.9	-91.3	-90.2		
CA_3A-40C	312		-94.2	-91.2	-89.5	-88.3		40
	40		-100	-97	-95.2	-94		
	312		[-94]	[-91]	[-89.2]	[-87.9]		41
CA_3A-41A ⁵	41		-97.5	-94.5	-92.7	-91.5		
_	3		-97	-94	-92.2	-91		3
	41 ¹²		[-93.3]	[-90.7]	[-89.2]	[-88.1]		
	312		[-94]	[-91]	[-89.2]	[-87.9]		41
CA_3A-41C ⁵	41		-97.5	-94.5	-92.7	-91.5		
	3		-97	-94	-92.2	-91		3
	41 ¹²		[-93.3]	[-90.7]	[-89.2]	[-88.1]		
24 24 44 42 45 6 7 8	3		-96.5	-93.5	-91.7	-90.5	FDD	0
CA_3A-41A-42A ^{5,6,7,8}	41 ¹²		[-93.3]	[-90.7]	[-89.2]	[-88.1]	TDD	3
	42 ¹²		-71.7	-71.7	-71.7	-71.7		
	3		-96.5	-93.5	-91.7	-90.5	FDD	
CA_3A-41A-42A ^{5,6,9}	41 ¹²		[-93.3]	[-90.7]	[-89.2]	[-88.1]	TDD	3
	42 ¹²		-97.1	-94.7	-93.2	-92.5		
	312		[-93.5]	[-90.5]	[-88.7]	[-87.4]	FDD	
CA_3A-41A-42A ^{5,6,10}	41		-97.5	-94.5	-92.7	-91.5	TDD	41
	42		-98.5	-95.5	-93.7	-92.5		
	7		-98	-95	-93.2	-92		7
CA_7A-40A	40		-96.3	-93.6	-92	-90.9		-
_ ****	7 ¹²		-97.1	-94.3	-92.7	-91.5		40
	40		-99.5	-96.5	-94.7	-93.5		
CA_7A-40C	7		-98	-95	-93.2	-92		7
5/1// 1 00	40		-96.3	-93.6	-92	-90.9	TDD	,

	712	-97.1	-94.3	-92.7	-91.5	FDD	40
	40	-99.5	-96.5	-94.7	-93.5	TDD	40
	7	-98	-95	-93.2	-92	FDD	7
04 74 404	42 ¹²	-95.6	-93	-91.5	-90.4	TDD	7
CA_7A-42A	712	-96.2	-93.2	-91.5	-90.3	FDD	40
	42	-98.5	-95.5	-93.7	-92.5	TDD	42
	7	-98	-95	-93.2	-92	FDD	7
04 74 404 404	42 ¹²	-95.6	-93	-91.5	-90.4	TDD	7
CA_7A-42A-42A	712	-96.2	-93.2	-91.5	-90.3	FDD	40
	42	-98.5	-95.5	-93.7	-92.5	TDD	42
04 004 404	28	-98.5	-95.5	-93.7	-91	FDD	00
CA_28A-40A	40	-95.1	-92.9	-91.4	-90.5	TDD	28
04 004 404	28	-96.8	-94.1	-92.5	-89.8	FDD	40
CA_28A-40A	40	-100	-97	-95.2	-94	TDD	40
CA 20A 40C	28	-98.5	-95.5	-93.7	-91	FDD	00
CA_28A-40C	40	-95.1	-92.9	-91.4	-90.5	TDD	28
CA 20A 40C	28	-96.8	-94.1	-92.5	-89.8	FDD	40
CA_28A-40C	40	-100	-97	-95.2	-94	TDD	40
CA 20A 40D	28	-98.5	-95.5	-93.7	-91	EDD	00
CA_28A-40D	40	-95.1	-92.9	-91.4	-90.5	FDD	28
CA 20A 40D	28	-96.8	-94.1	-92.5	-89.8	EDD	40
CA_28A-40D	40	-100	-97	-95.2	-94	FDD	40

- NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5A
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: The signal power is specified per port
- NOTE 4: These requirements apply regardless of the channel bandwidth and the location of UL band.
- NOTE 5: The B41 requirements are modified by -0.5dB when carrier frequency of the assigned E-UTRA channel bandwidth is within 2545-2690 MHz.
- NOTE 6: The antenna isolation for MSD calculation is assumed as 10 dB. For conducted mode REFSENS test such antenna isolation is not observed as the antennas are disconnected. Additionally antenna isolation assumption is under discussion depending on the frequency range
- NOTE 7: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band and a range ΔF_{HD} above and below the edge of this downlink transmission bandwidth. The value ΔF_{HD} depends on the E-UTRA configuration: ΔF_{HD} = 10 MHz for CA_3A-42A, CA_3A-42C, CA_1A-3A-42A, CA_1A-3A-42C, CA_3A-19A-42A and CA_1A-3A-19A-42A, CA_3A-41A-42A.
- NOTE 8: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \left \lfloor f_{DL}^{HB} / 0.2 \right \rfloor 0.1$ in MHz and $F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \le f_{UL_high}^{LB} BW_{Channel}^{LB} / 2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.
- NOTE 9: The requirements are only applicable to channel bandwidths with a carrier frequency at $\pm \left(20 + BW_{Channel}^{HB} / 2\right) \text{ MHz offset from } 2f_{UL}^{LB} \text{ in the victim (higher band) with } \\ F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL_high}^{LB} BW_{Channel}^{LB} / 2 \text{, where } BW_{Channel}^{LB} \text{ are the channel bandwidths configured in the aggressor (lower) and victim (higher) bands in MHz, respectively.}$
- NOTE 10: Only applicable for UE supporting inter-band carrier aggregation with uplink in one E-UTRA band and without simultaneous Rx/Tx.
- NOTE 11: Void
- NOTE 12: Applicable for the operations with 2 or 4 antenna ports supported in the band with carrier aggregation configured.

Table 7.3.1A-0bF: Uplink configuration for reference sensitivity (exceptions due to cross band isolation issues of TDD and FDD bands)

E-UTRA Ba	nd / Channe	el bandwi	dth of th	e affecte	d DL ban	d / N _{RB} / C	Ouplex mo	ode
EUTRA CA Configuration	E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode
CA_1A-5A-40A	1			25	50	75	100	FDD
CA_1A-3A-40A	40			25	50	75	100	TDD
CA_1A-8A-40A	1			25	50	75	100	FDD
	40			25	50	75	100	TDD
CA_1A-40A	1			25	50	75	100	FDD
CA_1A-40A	40			25	50	75	100	TDD
CA_3A-7A-38A	3			25	50	50 ¹	50 ¹	FDD
CA_3A-8A-40A	3			25	50	50 ¹	50 ¹	FDD
	40			25	50	75	100	TDD
CA_3A-40A	3			25	50	50 ¹	50 ¹	FDD
CA_3A-40C CA_1A-3A-40A CA_3A-5A-40A CA_3A-28A-40A CA_3A-28A- 40C CA_1A-3A-5A- 40A CA_1A-3A-8A- 40A	40			25	50	75	100	TDD
CA_3A-41A	3			25	50	50 ¹	50 ¹	FDD
CA_3A-41A	41			25	50	75	100	TDD
CA_3A-41C	3			25	50	50 ¹	50 ¹	FDD
CA_3A-410	41			25	50	75	100	TDD
	3			25	50	50 ¹	50 ¹	FDD
CA_3A-41A-42A	41			25	50	75	100	TDD
CA_7A-40A,	7			25	50	75	75 ¹	FDD
CA_7A-40C	40			25	50	75	100	TDD
CA_7A-42A,	7			25	50	75	75 ¹	FDD
CA_7A-42A-42A	42			25	50	75	100	TDD
CA_28A-40A,	28			25	25 ¹	25 ¹	25 ¹	FDD
CA_28A-40C	40			25	50	75	100	TDD

NOTE 1: ¹ refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 2: the UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.1-2 for the uplink bandwidth in which case the allocation according to Table 7.3.1-2 applies.

For band combinations including operating bands without uplink band (as noted in Table 5.5-1), the requirements are specified in Table 7.3.1A-0d for any uplink band with uplink configuration specified in Table 7.3.1-2.

Table 7.3.1A-0d: Reference sensitivity QPSK PREFSENS (CA with a SDL band)

			annel ban					
EUTRA CA	EUTRA	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex
Configuration	band	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	mode
	2			-97.7	-94.7	-92.9	-91.7	
CA_2A-4A-5A-29A	4			-99.7	-96.7	-94.9	-93.7	FDD
	5			-98	-95			
	29			-97	-94			
	2			-97.7	-94.7	-92.9	-91.7	
CA_2A-4A-29A	4			-99.7	-96.7	-94.9	-93.7	FDD
	29			-97	-94			
	2			-97.6	-94.6	-92.8	-91.6	
CA_2A-4A-29A-30A	4			-99.6	-96.6	-94.8	-93.6	FDD
6/1_2/1 // 26/1 66/1	29			-97	-94			. 55
	30			-98.5	-95.5			
	2			-98	-95	-93.2	-92	
CA_2A-5A-29A	5			-98	-95			FDD
	29			-97	-94			
CA 2A 20A	2			-98	-95	-93.2	-92	FDD
CA_2A-29A	29		-98.7	-97	-94			FUU
04 00 004	2			-98	-95	-93.2	-92	EDD
CA_2C-29A	29			-97	-94			FDD
	2			-97.6	-94.6	-92.8	-91.6	
CA_2A-29A-30A	29			-97	-94			FDD
	30			-98.5	-95.5			
	2			-97.6	-94.6	-92.8	-91.6	
CA_2C-29A-30A	29			-97	-94			FDD
	30			-98.5	-95.5		-91.6 -94	
0.1 .11	4			-100	-97	-95.2	-94	
CA_4A-4A-29A	29			-97	-94			FDD
	4			-99.6	-96.6	-94.8	-93.6	
CA_4A-4A-29A-30A	29			-97	-94			FDD
	30			-98.5	-95.5			
	4			-100	-97	-95.2	-94	
CA_4A-5A-29A	5			-98	-95			FDD
o,	29			-97	-94			
	4			-100	-97	-95.2	-94	
CA_4A-29A	29		-98.7	-97	-94	00.2	<u> </u>	FDD
	4		00.1	-99.6	-96.6	-94.8	-93.6	
CA_4A-29A-30A	29			-97	-94	0 1.0	00.0	FDD
OA_ 1 A-29A-30A	30			-98.5	-95.5			100
	5			-98	-95.5 -95			
CA_5A-29A	29			-97	-94			FDD
	29			-97 -97	-9 4 -94			
CA_20A-32A	32			-100	-9 4 -97	-95.2	-94	FDD
	20			-97	-94	-91.2	-90	
CA_20A-67A	67			-100	-97	-95.2	-94	FDD
	23			-100	-97	-95.2	-94	
CA_23A-29A	29		-98.7	-97	-94			FDD
	29			-97	-94			
CA_29A-30A	30			-99	-96			FDD

NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

NOTE 3: The signal power is specified per port.

NOTE 4: Void

Table 7.3.1A-0e: Void

For band combinations including operating band 46 (Table 5.5-1), the requirements are specified in Table 7.3.1A-0eA, and Table 7.3.1A-0eC for the uplink in any band other than band 46 with the uplink configuration specified in Table 7.3.1-2.

Table 7.3.1A-0eA: Reference sensitivity QPSK PREFSENS (CA with band 46)

	Channel bandwidth										
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex mode			
CA 1A 16A	1			-100	-97	-95.2	-94	FDD			
CA_1A-46A	46						-90	TDD			
CA 2A 4CA	2			-98	-95	-93.2	-92	FDD			
CA_2A-46A	46						-90	TDD			
CA 2A 4CA	3			-97	-94	-92.2	-91	FDD			
CA_3A-46A	46						-90	TDD			
CA 4A 4CA	4			-100	-97	-95.2	-94	FDD			
CA_4A-46A	46						-90	TDD			
CA 7A 4CA	7			-98	-95	-93.2	-92	FDD			
CA_7A-46A	46						-90	TDD			
CA 44A 4CA	41			-98	-95	-93.2	-92	TDD			
CA_41A-46A	46						-90	TDD			
CA 42A 46A	42			-99	-96	-94.2	-93	TDD			
CA_42A-46A	46						-83	TDD			

NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in Annex A.5.1.1/A.5.2.1/A.5.4.1.

NOTE 3: The signal power is specified per port.

NOTE 4: Void

NOTE 5: The requirement for B46 does not apply when there is at least one individual RE within the B46 downlink transmission bandwidth which falls into the reference sensitivity exclusion region as specified in Table 7.3.1A-0eC.

NOTE 6: Void

Table 7.3.1A-0eB: Void

Table 7.3.1A-0eC specifies the Band 46 reference measurement exclusion region for different licensed component carriers and channel bandwidth. The exclusion region is defined according to the licensed component carrier channel bandwidth. The UL configurations to be adopted for the test are specified in Table 7.3.1-2. The exclusion region in Table 7.3.1A-0eC is specified for the case of 10MHz and 20MHz channel bandwidth in Band 46.

Table 7.3.1A-0eC: Band 46 Reference sensitivity measurement exclusion region in MHz.

Licens	Licensed Component Carriers / E-UTRA Band / Harmonic order / Channel BW in UL										
Licensed Component Carriers	Harmonic order	5MHz	10MHz	15MHz	20MHz						
1	3	+/- 15	+/- 23	+/- 35	+/- 45						
2	3	+/- 15	+/- 23	+/- 35	+/- 45						
3	3	+/- 15	+/- 23	+/- 35	+/- 45						
4	3	+/- 15	+/- 23	+/- 35	+/- 45						
7 ¹	2	+/- 15	+/- 25	+/- 38	+/- 50						
41	2	+/- 15	+/- 25	+/- 38	+/- 50						

NOTE 1: Even though UL harmonic does not fall directly into Band 46 the exclusion region still applies.

NOTE 2: The center of the exclusion region is obtained by multiplying the UL channel center frequency by the harmonic order.

In all cases for single uplink inter-band CA, unless given by Table 7.3.1-3 for the band with the active uplink carrier, the applicable reference sensitivity requirements shall be verified with the network signalling value NS_01 (Table 6.2.4-1) configured.

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to two E-UTRA bands the throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1 and Table 7.3.1-2. The reference sensitivity is defined to be met with all downlink component carriers active and both of the uplink carriers active.

For E-UTRA CA configurations with uplink and downlink assigned to two E-UTRA bands given in Table 7.3.1A-0f the reference sensitivity is defined only for the specific uplink and downlink test points which are specified in Table 7.3.1A-0f. For E-UTRA CA configurations with uplink assigned to two E-UTRA bands and downlink assigned to three E-UTRA bands given in Table 7.3.1A-0g the reference sensitivity is defined only for the specific uplink and downlink test points which are specified in Table 7.3.1A-0g. For these test points the reference sensitivity requirement specified in Table 7.3.1-1 is relaxed by the amount of parameter MSD given in Table 7.3.1A-0f.

The allowed exceptions defined in Table 7.3.1A-0a and Table 7.3.1A-0b for inter-band carrier aggregation with a single active uplink are also applicable for dual uplink operation.

Table 7.3.1A-0f: 2 UL and 2 DL interband Reference sensitivity QPSK P_{REFSENS} and uplink/downlink configurations

E-UTRA Band / Channel bandwidth / NRB / Duplex mode									
EUTRA CA Configuration	EUTRA band	UL F _c (MHz)	UL/DL BW (MHz)	UL C _{LRB}	DL F _c (MHz)	MSD (dB)	Duplex mode		

<u> </u>	1	1950	5	25	2140	23	
CA_1A-3A	3	1760	5	25	1855	N/A	FDD
0.4.4.0.4	1	1965	5	25	2155	6	
CA_1A-8A	8	887.5	5	25	932.5	N/A	FDD
04.04.44	2	1860	20	50 ²	1940	5	500
CA_2A-4A	4	1752.5	5	25	2152.5	N/A	FDD
04.04.44	2	1868.3	5	25	1948.3	N/A	
CA_2A-4A	4	1735	5	25	2135	5	FDD
04.04.54	3	1771	10	50	1866	4	
CA_3A-5A	5	838	5	25	883	N/A	FDD
CA 2A 5A	3	1721	10	50	1816	N/A	EDD
CA_3A-5A	5	838	5	25	883	24	FDD
CA 2A 7A	3	1730	5	25	1825	N/A	EDD
CA_3A-7A	7	2535	10	50	2655	13	FDD
CA 2A 0A	3	1755	10	50	1850	N/A	EDD
CA_3A-8A	8	900	5	25	945	8	FDD
CA 2A 0A	3	1747.5	10	50	1842.5	6.4	EDD
CA_3A-8A	8	897.5	5	25	942.5	N/A	FDD
CA 2A 10A	3	1771	5	25	1866	4	EDD
CA_3A-19A	19	838	5	25	883	N/A	FDD
CA 2A 10A	3	1721	5	25	1816	N/A	FDD
CA_3A-19A	19	838	5	25	883	27	רטט
CA 2A 20A	3	1775	5	25	1870	4	FDD
CA_3A-20A	20	840	5	25	799	N/A	רטט
CA_3A-20A	3	1735	5	25	1830	N/A	FDD
CA_3A-20A	20	847	5	25	806	9	רטט
CA_3A-26A	3	1771	5	25	1866	4	FDD
CA_3A-26A	26	838	5	25	883	N/A	רטט
CA_3A-26A	3	1721	5	25	1816	N/A	FDD
CA_3A-26A	26	838	5	25	883	26	רטט
CA_4A-5A	4	1721	5	25	2121	N/A	FDD
CA_4A-5A	5	838	5	25	883	26	רטט
CA_4A-7A	4	1730	5	25	2130	N/A	FDD
UA_4A-7A	7	2535	5	25	2655	15	FUU
CA 5A-7A	5	834	5	25	879	12	FDD
CA_5A-7A	7	2547	10	50	2667	N/A	FUU
CA_7A-20A	7	2512	10	50	2632	N/A	FDD
UA_1 A-20A	20	851	5	25	810	12	רטט

NOTE 1: Both of the transmitters shall be set min(+20 dBm, $P_{CMAX_L,c}$) as defined in subclause 6.2.5A NOTE 2: RB_{START} = 0

Table 7.3.1A-0g: 2 UL and 3 DL interband Reference sensitivity QPSK PREFSENS and uplink/downlink configurations

	E	-UTRA Ba	nd / Chann	el bandwid	th / NRB / D	uplex mode	•		
EUTRA CA	EUTRA CA	EUTRA	UL Fc	UL BW	UL	DL F _c (MHz)	DL BW	MSD	Duplex
DL Configuration	UL Configurati on	band	(MHz)	(MHz)	C _{LRB}	(MHz)	(MHz)	(dB)	mode
		1	1968	5	25	2158	5	NA	
CA_1A-5A-7A	CA_1A-7A	7	2512	10	50	2632	10	NA	FDD
		5	835	5	25	880	5	1.0	
		3	1737	5	25	1832	5	NA	
CA_3A-7A	CA_3A-7A	7	2543	10	50	2663	10	NA	FDD
CA_3A-7A-20A		20	847	10	20	806	10	10.5	
CA_3A-7A-20A		3	1775	10	50	1870	10	NA	
	CA_3A-20A	20	855	5	25	896	5	NA	FDD
		7	2510	10	50	2630	10	26.0	
		3	1747	5	25	1842	5	NA	
	CA_3A-7A	7	2543	5	25	2663	5	NA	FDD
CA 2A 7A 29A	_	28	741	5	25	796.0	5	20	
CA_3A-7A-28A		7	2543	5	25	2663	5	NA	
	CA_7A-28A	28	710.5	5	25	765.5	5	NA	FDD
	CA_7A-28A	3	1737.5	5	25	1832.5	5	26	

For intra-band contiguous carrier aggregation the throughput of each component carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1-1, Table 7.3.1-1a, Table 7.3.1-1A, Table 7.3.1-1B, Table 7.3.1-1C, Table 7.3.1-0h and Table 7.3.1A-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the power levels in Table 7.3.1-1 and Table 7.3.1-1a also apply for an SCC assigned in the unpaired part. The requirement is verified using an uplink CA configuration with the largest number of carriers supported by the UE. Table 7.3.1A-1 specifies the maximum number of allocated uplink resource blocks for which the intra-band contiguous carrier aggregation reference sensitivity requirement shall be met. The PCC and SCC allocations as defined in Table 7.3.1A-1 form a contiguous allocation where TX–RX frequency separations of the component carriers are as defined in Table 5.7.4-1. In case downlink CA configuration has additional SCC(s) compared to uplink CA configuration those are configured furthers away from uplink band. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2 and the downlink PCC carrier center frequency shall be configured closer to uplink operating band than any of the downlink SCC center frequency. Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS_01 (Table 6.2.4-1) configured.

Table 7.3.1A-0h: Intra-band contiguous CA uplink configuration for reference sensitivity for Bandwidth Class B

CA	CA configuration / CC combination / N _{RB_agg} / Duplex mode										
Unlink C	A configuration	50RB-	+25RB	50RB-	-50RB	Duplex					
Opinik C	A configuration	PCC	SCC	PCC	SCC	Mode					
	CA_8B	25	0	25	0	FDD					
NOTE 1:	The carrier centr	e frequen	icy of SCC	in the U	L operatin	ng band is					
	configured close	r to the D	L operatin	ig band.	•						
NOTE 2:	The transmitted	power over	er both PC	CC and So	CC shall b	e set to					
	Pumax as defined										
NOTE 3:	The UL resource	blocks in	both PC	C and SC	C shall be	e confined					
	within the transm	nission ba	ndwidth c	onfigurati	on for the	channel					
	bandwidth (Table	e 5.6-1).		Ū							
NOTE 4:	The UL resource	blocks ir	PCC sha	all be loca	ted as clo	se as					
	possible to the d	ownlink o	perating b	and, whil	e the UL i	resource					
	blocks in SCC sl	nall be loc	ated as fa	ar as poss	ible from	the					
	downlink operati	ng band.		•							
NOTE 5:	In case a CA cor		n consists	of CC cha	annel ban	dwidths					
	nnel band										
	shall be the large										
I	J				•						

Table 7.3.1A-1: Intra-band contiguous CA uplink configuration for reference sensitivity for Bandwidth

	CA configuration / CC combination / NRB_agg / Duplex mode													
Uplink CA			+50RB	75RB+75RB		100RB+75RB		100RB+100RB		Duplex				
configuration	PCC	SCC	PCC	SCC	PCC	SCC	PCC	SCC	PCC	SCC	PCC	SCC	Mode	
CA_1C	N/A	N/A	N/A	N/A	75	54	N/A	N/A	N/A	N/A	100	30	FDD	
CA_3C	50	0	50	0	N/A	N/A	N/A	N/A	50	0	50	0	FDD	
CA_7C	N/A	N/A	75	0	75	0	75	0	75	0	75	0	FDD	
CA_38C	N/A	N/A	N/A	N/A	75	75	N/A	N/A	N/A	N/A	100	100	TDD	
CA_39C	100	25	100	50	N/A	N/A	N/A	N/A	100	75	N/A	N/A	TDD	
CA_40C	N/A	N/A	100	50	75	75	N/A	N/A	100	75	100	100	TDD	
CA_41C	100	25	100	50	75	75	75	50	100	75	100	100	TDD	
CA_42C	100	25	100	50	N/A	N/A	N/A	N/A	100	75	100	100	TDD	

NOTE 1: The carrier centre frequency of SCC in the UL operating band is configured closer to the DL operating band.

NOTE 2: The transmitted power over both PCC and SCC shall be set to Pumax as defined in subclause 6.2.5A.

NOTE 3: The UL resource blocks in both PCC and SCC shall be confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 4: The UL resource blocks in PCC shall be located as close as possible to the downlink operating band, while the UL resource blocks in SCC shall be located as far as possible from the downlink operating band.

NOTE 5: In case a CA configuration consists of CC channel bandwidths which are unequal in bandwidth the PCC channel bandwidth shall be the larger one for reference sensitivity test.

NOTE 6: Void. NOTE 7: Void

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the throughput of each downlink component carrier shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) and parameters specified in Table 7.3.1-1, Table 7.3.1-1a, Table 7.3.1-1A, Table 7.3.1-1B, Table 7.3.1-1C and Table 7.3.1A-3 with the reference sensitivity power level increased by ΔR_{IBNC} given in Table 7.3.1A-3 for the SCC(s). The requirements apply with all downlink carriers active. Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS_01 (Table 6.2.4-1) configured.

Table 7.3.1A-3: Intra-band non-contiguous CA with one uplink configuration for reference sensitivity

CA configuration	Aggregated channel bandwidth (PCC+SCC)	W _{gap} / [MHz]	UL PCC allocation	ΔR _{IBNC} (dB)	Duplex mode
	(1 00+000)	30.0 < W _{gap} ≤ 50.0	12 ¹	5.3	
	25RB+25RB	$30.0 < W_{gap} \le 50.0$	12 ¹	8.017	
		$0.0 < W_{gap} \le 30.0$	25 ¹	0	
		$25.0 < W_{gap} \le 45.0$	12 ¹	4.4	
	25RB+50RB	$25.0 < W_{gap} \le 45.0$	12 ¹	7.1 ¹⁷	
		$0.0 < W_{gap} \le 25.0$	25 ¹	0	1
		$20.0 < W_{gap} \le 40.0$	12 ¹	4.2	1
	25RB+75RB	$20.0 < W_{gap} \le 40.0$	12 ¹	6.9 ¹⁷	
	20110170110	$0.0 < W_{gap} \le 20.0$	25 ¹	0.9	
					1
		$15.0 < W_{gap} \le 35.0$	12 ¹	3.8	
	25RB+100RB	$30.0 < W_{gap} \le 50.0$	12 ¹	6.5 ¹⁷	
		$0.0 < W_{gap} \le 15.0$	25 ¹	0	
		$15.0 < W_{gap} \le 45.0$	12 ¹	5.9	
	50RB+25RB	$15.0 < W_{gap} \le 45.0$	12 ¹	8.6 ¹⁷	
		$0.0 < W_{gap} \le 15.0$	32 ¹	0	1
		10.0 < W _{gap} ≤ 40.0	12 ¹	4.6	_
	50RB+50RB	$10.0 < W_{gap} \le 45.0$	12 ¹	7.317	
		$0.0 < W_{gap} \le 10.0$	32 ¹	0	
		$5.0 < W_{gap} \le 35.0$	12 ¹	4.1	
CA_2A-2A	50RB+75RB	$5.0 < W_{gap} \le 35.0$	12 ¹	6.8 ¹⁷	
		$0.0 < W_{gap} \le 5.0$	32 ¹	0	
	50RR+100RR	$0.0 < W_{gap} \le 30.0$	12 ¹	4.0	FDD
	50RB+100RB	0.0 < W _{gap} ≤ 30.0	12 ¹	6.7 ¹⁷	1
		10.0 < W _{gap} ≤ 40.0	12 ¹²	6.7	1
	75RB+25RB	10.0 < W _{gap} ≤ 40.0	12 ¹	9.4 ¹⁷	
		0.0 < W _{gap} ≤ 10.0	36 ¹	0	
		5.0 < W _{gap} ≤ 35.0	12 ¹²	5.4	
	7500.5000		12 ¹²	8.1 ¹⁷	
	75RB+50RB	$5.0 < W_{gap} \le 35.0$ $0.0 < W_{gap} \le 5.0$	_		_
		<u> </u>	36 ¹	0	
	75RB+75RB	$0.0 < W_{gap} \le 30.0$	12 ¹²	4.6	
		$0.0 < W_{gap} \le 30.0$	12 ¹²	7.3 ¹⁷	
	75RB+100RB	$0.0 < W_{gap} \le 25.0$	12 ¹²	4.2	
	73110+100110	$0.0 < W_{gap} \le 25.0$	12 ¹²	6.9 ¹⁷	
	40000 0500	$0.0 < W_{gap} \le 35.0$	16 ¹³	7.2	
	100RB+25RB	$0.0 < W_{gap} \le 35.0$	16 ¹²	9.9 ¹⁷	
		$0.0 < W_{gap} \le 30.0$	16 ¹³	5.8	-
	100RB+50RB	0.0 < W _{gap} ≤ 30.0	16 ¹³	8.5 ¹⁷	
		$0.0 < \text{Wgap} \le 30.0$ $0.0 < \text{Wgap} \le 25.0$	_		1
	100RB+75RB		16 ¹³	5.0	+
		$0.0 < W_{gap} \le 25.0$	16 ¹³	7.7 ¹⁷	1
	100RB+100RB	$0.0 < W_{gap} \le 20.0$	16 ¹³	4.6	-
	25RB+25RB	$0.0 < W_{gap} \le 20.0$	16 ¹³	7.3 ¹⁷	
		$45.0 < W_{gap} \le 65.0$	12 ¹	4.7	1
		$45.0 < W_{gap} \le 65.0$	12 ¹	7.4 ¹⁷	_
CA_3A-3A				0	FDD
JA_JA-JA	0500 5500	$40.0 < W_{gap} \le 60.0$	12 ¹	3.8	
	25RB+50RB	40.0 < W _{gap} ≤ 60.0	12 ¹	6.5 ¹⁷	1

		$0.0 < W_{gap} \le 40.0$	25 ¹	0	
		$35.0 < W_{gap} \le 55.0$	12 ¹	3.6	
	25RB+75RB	$35.0 < W_{gap} \le 55.0$	12 ¹	6.3 ¹⁷	
		$0.0 < W_{gap} \le 35.0$	25 ¹	0	
		$30.0 < W_{gap} \le 50.0$	12 ¹	3.4	
	25RB+100RB	$30.0 < W_{gap} \le 50.0$	12 ¹	6.1 ¹⁷	
		$0.0 < W_{gap} \le 30.0$	25 ¹	0	
		$30.0 < W_{gap} \le 60.0$	12 ⁹	5.1	
	50RB+25RB	$30.0 < W_{gap} \le 60.0$	12 ⁹	7.8 ¹⁷	
		$0.0 < W_{gap} \le 30.0$	32 ¹	0	
		$25.0 < W_{gap} \le 55.0$	12 ⁹	4.3	
	50RB+50RB	$25.0 < W_{gap} \le 55.0$	12 ⁹	7.0 ¹⁷	
		$0.0 < W_{gap} \le 25.0$	32 ¹	0	
		$20.0 < W_{gap} \le 50.0$	12 ⁹	3.8	
	50RB+75RB	$20.0 < W_{gap} \le 50.0$	12 ⁹	6.5 ¹⁷	
		$0.0 < W_{gap} \le 20.0$	32 ¹	0	
		$15.0 < W_{gap} \le 45.0$	12 ⁹	3.4	
	50RB+100RB	15.0 < W _{gap} ≤ 45.0	12 ⁹	6.1 ¹⁷	
		$0.0 < W_{gap} \le 15.0$	32 ¹	0	
		$25.0 < W_{gap} \le 55.0$	12 ¹⁰	6.0	
	75RB+25RB	$25.0 < W_{gap} \le 55.0$	12 ¹⁰	8.7 ¹⁷	
		$0.0 < W_{gap} \le 25.0$	32 ¹	0	
		$20.0 < W_{gap} \le 50.0$	12 ¹⁰	4.7	
	75RB+50RB	$20.0 < W_{gap} \le 50.0$	12 ¹⁰	7.4 ¹⁷	
		$0.0 < W_{gap} \le 20.0$	32 ¹	0	
		$15.0 < W_{gap} \le 45.0$	12 ¹⁰	4.2	
	75RB+75RB	$15.0 < W_{gap} \le 45.0$	12 ¹⁰	6.9 ¹⁷	
		$0.0 < W_{gap} \le 15.0$	32 ¹	0	
		$10.0 < W_{gap} \le 40.0$	12 ¹⁰	3.8	
	75RB+100RB	$10.0 < W_{gap} \le 40.0$	12 ¹⁰	6.5 ¹⁷	
		$0.0 < W_{gap} \le 10.0$	32 ¹	0	
		$15.0 < W_{gap} \le 50.0$	16 ¹¹	6.5	
	100RB+25RB	$15.0 < W_{gap} \le 50.0$	16 ¹¹	9.2 ¹⁷	
		$0.0 < W_{gap} \le 15.0$	32 ¹	0	
		$10.0 < W_{gap} \le 45.0$	16 ¹¹	5.1	
	100RB+50RB	$10.0 < W_{gap} \le 45.0$	16 ¹¹	7.8 ¹⁷	
		$0.0 < W_{gap} \le 10.0$	32 ¹	0	
		$5.0 < W_{gap} \le 40.0$	16 ¹¹	4.5	
	100RB+75RB	$5.0 < W_{gap} \le 40.0$	16 ¹¹	7.2 ¹⁷	
		$0.0 < W_{gap} \le 5.0$	32 ¹	0	
	400DD : 400DD	$0.0 < W_{gap} \le 35.0$	16 ¹¹	4.1	
	100RB+100RB	$0.0 < W_{gap} \le 35.0$	16 ¹¹	6.8 ¹⁷	
CA_4A-4A	NOTE 6	NOTE 7	NOTE 8	0.0	FDD
	25RB+25RB 25RB+50RB	NOTE 7 NOTE 7	12 ¹ 12 ¹	5.3 4.4	
CA_5A-5A	50RB+25RB	NOTE 7	12 ¹	5.9	FDD
	50RB+50RB	NOTE 7	12 ¹	4.6	
	25RB+25RB	$0 < W_{gap} \le 60$	25	0.0	
CA_7A-7A	25RB+50RB 25RB+75RB	$0 < W_{gap} \le 55$ $0 < W_{gap} \le 50$	25 25	0.0	FDD
	25RB+100RB	$0 < W_{\text{gap}} \le 50$ $0 < W_{\text{gap}} \le 45$	25	0.0	
I		3∾4			<u> </u>

	50DB 25DB	$30 < W_{gap} \leqslant 55$	32 ¹	0.0	
	50RB+25RB	$0 < W_{gap} \leqslant 30$	50	0.0	
	50RB+50RB	$25.0 < W_{gap} \le 50.0$	32 ¹	0.0	Ī
		$0.0 < W_{gap} \le 25.0$	50	0.0]
	50DD : 75DD	20 < W _{gap} ≤ 45	32 ¹	0.0	
	50RB+75RB	0 < W _{gap} ≤ 20	50	0.0	
		15 < W _{gap} ≤ 40	32 ¹	0.0	1
	50RB+100RB	$0 < W_{gap} \le 15$	50	0.0	1
	75RB+25RB	$20.0 < W_{gap} \le 50.0$	32 ¹	0.0	}
	70110120110	$0.0 < W_{gap} \le 20.0$	50 ¹	0.0	1
	75RB+50RB	$20.0 < W_{gap} \le 45.0$	32 ¹	0.0	!
		$0.0 < W_{gap} \le 20.0$	50 ¹	0.0	
	75RB+75RB	$15.0 < W_{gap} \le 40.0$	32 ¹	0.0	1
		$0.0 < W_{gap} \le 15.0$	50 ¹	0.0	
	7500 40000	10 < W _{gap} ≤ 35	32 ¹	0.0	ĺ
	75RB+100RB	0 < W _{gap} ≤ 10	50 ¹	0.0	1
		25 < W _{gap} ≤ 45	32 ¹	0.0	
	100RB+25RB	$0 < W_{gap} \le 25$	45 ¹	0.0	-
		20 < Wgap ≤ 40	32 ¹	0.0	
	100RB+50RB	$0 < W_{gap} \le 40$	45 ¹	0.0	-
	400DD . 75DD		36 ¹		<u> </u>
	100RB+75RB	$15.0 < W_{gap} \le 35.0$ $0.0 < W_{gap} \le 15.0$	50 ¹	0.0	-
	100RB+100RB	$15.0 < W_{gap} \le 15.0$	32 ¹	0.0	1
	100KD+100KB	$0.0 < W_{gap} \le 30.0$	45 ¹	0.0	-
CA 23A-23A	NOTE 6	0.0 < Wgap ≤ 15.0 NOTE 7	NOTE 8	0.0	FDD
OA_23A-23A		$30.0 < W_{gap} \le 55.0$	10 ¹	5.0	100
	25RB+25RB	$0.0 < W_{gap} \le 30.0$	25 ¹	0.0	
		25.0 < W _{gap} ≤ 50.0	10 ¹	4.5	1
	25RB+50RB	$0.0 < W_{gap} \le 25.0$	25 ¹	0.0	1
	0500.7500	20 < W _{gap} ≤ 45	10 ¹	4.3	Ĭ
	25RB+75RB	0 < W _{gap} ≤ 20	25 ¹	0	
	25RB+100RB	15 < W _{gap} ≤ 40	10 ¹	4.1	
	23ND+100ND	0 < W _{gap} ≤ 15	25 ¹	0]
	50RB+25RB	15.0 < W _{gap} ≤ 50.0	10 ⁴	5.5	
	OUNDIZOND	$0.0 < W_{gap} \le 15.0$	32 ¹	0.0	<u> </u>
	50RB+50RB	$10.0 < W_{gap} \le 45.0$	10 ⁴	5.0	
04 054 054		$0.0 < W_{gap} \le 10.0$	321	0.0	
CA_25A-25A	50RB+75RB	5 < W _{gap} ≤ 40	10 ⁴	4.5	FDD
	FODD : 400DD	$0 < W_{gap} \le 5$	32 ¹	0	}
	50RB+100RB	$0 < W_{gap} \le 35$	10 ⁴	4.2 7.6	<u> </u>
	75RB+25RB	$10 < W_{gap} \le 45$ 0 < W _{gap} ≤ 10	32 ¹	0	-
		$5 < W_{\text{gap}} \le 10$	10 ¹⁴	6.7	1
	75RB+50RB	$0 < W_{gap} \le 5$	32 ¹	0	
	75RB+75RB	0 < W _{gap} ≤ 35	1014	5.6	!
	75RB+100RB	$0 < W_{gap} \le 30$	1014	4.8	1
	100RB+25RB	0 < W _{gap} ≤ 40	12 ¹⁵	8	1
	100RB+50RB	0 < W _{gap} ≤ 35	12 ¹⁵	6.7	Ī
	100RB+75RB	0 < W _{gap} ≤ 30	12 ¹⁵	6.1	
	100RB+100RB	0 < W _{gap} ≤ 25	12 ¹⁵	5.7	
CA_40A-40A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_41A-41A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_41A-41C	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_41A-41D	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_41C-41C	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_42A-42A	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_42A-42C	NOTE 6	NOTE 7	NOTE 8	0.0	TDD
CA_42A-42D CA 42C-42C	NOTE 6	NOTE 7	NOTE 8	0.0	TDD TDD
UA_42U-42U	NOTE 6	NOTE 7	NOTE 8	0.0	טטו
CA_66A-66A	NOTE 6	NOTE 7	NOTE 8, NOTE 16	0.0	FDD
	L		INCIE 10	<u> </u>	<u> </u>

NOTE 1: ¹ refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission.

NOTE 2: W_{gap} is the sub-block gap between the two sub-blocks.

- NOTE 3: The carrier center frequency of PCC in the UL operating band is configured closer to the DL operating band.
- NOTE 4: 4 refers to the UL resource blocks shall be located at RB_{start}=33.
- NOTE 5: For the TDD intra-band non-contiguous CA configurations, the minimum requirements apply only in synchronized operation between all component carriers.
- NOTE 6: All combinations of channel bandwidths defined in Table 5.6A.1-3.
- NOTE 7: All applicable sub-block gap sizes.
- NOTE 8: The PCC allocation is same as Transmission bandwidth configuration N_{RB} as defined in Table 5.6-1. In case of uplink sub-block is TDD intra-band contiguous CA then the uplink PCC and SCC allocations are the same as N_{RB_agg} defined in Table 7.3.1A-1.
- NOTE 9: 9 refers to the UL resource blocks shall be located at RB_{start}=25.
- NOTE 10: 10 refers to the UL resource blocks shall be located at RB_{start}=35.
- NOTE 11: 11 refers to the UL resource blocks shall be located at RB_{start}=50.
- NOTE 12: 12 refers to the UL resource blocks shall be located at RB_{start}=39.
- NOTE 13: ¹³ refers to the UL resource blocks shall be located at RB_{start}=57.
- NOTE 14: 14 refers to the UL resource blocks shall be located at RB_{start}=44.
- NOTE 15: 15 refers to the UL resource blocks shall be located at RB_{start}=62.
- NOTE 16: The carrier center frequency of PCC in the DL operating band is configured closer to the UL operating band.
- NOTE 17: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

For intra-band non-contiguous carrier aggregation with two uplink and downlink carriers the reference sensitivity is defined to be met with both downlink and uplink carriers activated. The downlink PCC and SCC minimum requirements for reference sensitivity power level as specified in Table 7.3.1-1, Table 7.3.1-1A, Table 7.3.1-1B and Table 7.3.1-1C are increased by amount of ΔR_{2UL_PCC} and ΔR_{2UL_SCC} which are defined in Table 7.3.1A-4 when uplink PCC and SCC allocations are according to the Table 7.3.1A-4.

Table 7.3.1A-4: Intra-band non-contiguous CA with two uplinks configuration for reference sensitivity

CA configuration	Aggregated channel bandwidth (PCC+SCC)	W _{gap} / [MHz]	UL PCC allocation	UL SCC allocation	ΔR _{2UL_PCC} (dB)	ΔR _{2UL_SCC} (dB)	Duplex mode
CA_4A-4A	NOTE 2	NOTE 3	NOTE 4	NOTE 5	0.0	0.0	FDD

- NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.5A.
- NOTE 2: All combinations of channel bandwidths defined in Table 5.6A.1-3.
- NOTE 3: All applicable sub-block gap sizes.
- NOTE 4: The PCC allocation is same as Transmission bandwidth configuration NRB as defined in Table 5.6-1.
- NOTE 5: The SCC allocation is same as Transmission bandwidth configuration N_{RB} as defined in Table 5.6-1.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two noncontiguous sub-blocks per band and up to four contiguously aggregated carriers per band) and up to three uplink carriers (up to two contiguously aggregated carriers per band), the requirement is defined with an uplink configuration in accordance with Table 7.3.1A-3 when the uplink is active in a band supporting two non-contigous component carriers, Table 7.3.1A-1 when the uplink (up to two contiguously aggregated uplink carriers) is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when an uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. The carrier center frequency of PCC in the UL operating band is configured closer to the DL operating band when the uplink is active in band(s) supporting non-contiguous aggregation of up to two sub-blocks. For these uplink configurations, the UE shall meet the reference sensitivity requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.3.1. For the two component carriers within the same band, $\Delta R_{IBNC} = 0$ dB for all sub-block gaps (Table 7.3.1A-3) when the uplink is active in another band. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with all uplink carriers active in each band capable of UL operation. For contiguously aggregated component carriers configured in Band 46, the said requirements for intra-band contiguous carrier aggregation of downlink carriers are replaced by the requirements in Table 7.3.1A-0eA for the uplink in any band other than band 46 with the uplink configuration specified in Table 7.3.1-2. Unless given by Table 7.3.1-3, the reference sensitivity requirements shall be verified with the network signalling value NS 01 (Table 6.2.4-1) configured. For the UE that supports any of combinations of intra-band and inter-band carrier aggregation given in Table 7.3.1A-5, exceptions to the aforementioned requirements are allowed when the uplink is active in a lower-frequency band and is within a specified frequency range such that transmitter harmonics fall within the downlink transmission bandwidth assigned in a higher band as noted in Table 7.3.1A-5. For these exceptions, the UE shall meet the requirements specified in Table 7.3.1A-5 and Table 7.3.1A-6.

Table 7.3.1A-5: Reference sensitivity for carrier aggregation QPSK PREFSENS, CA (exceptions due to harmonic issues in the combinations of intra-band and inter-band CA)

			Channel ba					
EUTRA CA Configuration	EUTRA band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duple mode
J	1 ¹⁸	, ,	` ′	-89.8	-89.4	-89	-88.7	
04 44 04 70 00456	3				-94	-92.2	-91	
CA_1A-3A-7C-28A ^{5,6}	7				-95	-93.2	-92	FDD
	28				-95.3	-93.5	-90.8	ĺ
	1			-99.8	-96.8	-95	-93.8	
CA_1A-3A-19A-	3			-96.8	-93.8	-92	-90.8	FDD
42C ^{8,9}	19			-100	-97	-95.2		İ
	42 ¹⁸			-71.7	-71.7	-71.7	-71.7	TDD
	1			-99.8	-96.8	-95	-93.8	
CA_1A-3A-19A-42C ¹⁰	3			-96.8	-93.8	-92	-90.8	FDD
CA_1A-3A-19A-42C	19			-100	-97	-95.2		
	42 ¹⁸			-97.1	-94.7	-93.2	-92.5	TDD
	1			-99.8	-96.8	-95	-93.8	FDD
CA_1A-3A-42C ^{8,9}	3			-96.8	-93.8	-92	-90.8	ן דטט
	42 ¹⁸			-71.7	-71.7	-71.7	-71.7	TDD
	1 ¹⁸			-89.8	-89.4	-89	-88.7	
CA_1A-7C-28A ^{5,6}	7				-95	-93.2	-92	FDD
	28				-95.3	-93.5	-90.8	
	1			-99.8	-96.8	-95	-93.8	FDD
CA_1A-3A-42C ¹⁰	3			-96.8	-93.8	-92	-90.8	ן רטט
	42 ¹⁸			-97.1	-94.7	-93.2	-92.5	TDD
	2			-97.7	-94.7	-92.9	-91.7	
CA_2A-2A-4A-12A ^{5,6}	4			-90	-89.5	-89	-88.5	FDD
	12			-96.5	-93.5			
	2			-97.7	-94.7	-92.9	-91.7	
CA_2A-4A-4A-12A ^{5,6}	4			-90	-89.5	-89	-88.5	FDD
	12			-96.5	-93.5			
04 04 04 044	3			N/A	N/A	N/A	N/A	
CA_3A-3A-8A ⁴	8			N/A	N/A			FDD
	3			-96.8	-93.8	-92	-90.8	
CA_3A-19A-42C ^{8,9}	19			-100	-97	-95.2	00.0	FDD
	42 ¹⁸			-71.7	-71.7	-71.7	-71.7	TDD
	3			-96.8	-93.8	-92	-90.8	
CA_3A-19A-42C ¹⁰	19			-100	-97	-95.2		FDD
	42 ¹⁸			-97.1	-94.7	-93.2	-92.5	TDD
	3			-96.8	-93.8	-92	-90.8	FDD
CA_3A-42C ^{8,9}				-71.7	-71.7	-71.7	-71.7	
	42 ¹⁸							TDD
CA_3A-42C ¹⁰	3			-96.8	-93.8	-92	-90.8	FDD
UA_3A-42U	42 ¹⁸			-97.1	-94.7	-93.2	-92.5	TDD
	4			-90	-89.5	-89	-88.5	
CA_4A-4A-5A-12A ^{5,6}	5			-97.5	-94.5			FDD
	12			-96.5	-93.5			1
0.4.4.4.4.0.4.5.6	4			-90	-89.5	-89	-88.5	
CA_4A-4A-12A ^{5,6}	12			-96.5	-93.5			FDE
04 44 44 404	4			-90	-89.5	-89	-88.5	
CA_4A-4A-12A-	12			-96.5	-93.5			FDD
30A ^{5,6}	30			-98.5	-95.5			i
OA 44 40056	4			-90	-89.5	-89	-88.5	
CA_4A-12B ^{5,6}	12			-96.5	-93.5			FDE
	8	N/A	N/A	N/A	N/A			FDE
CA_8A-41C ⁷	41				N/A	N/A	N/A	TDD
	8	-102	-99	-96.8	-93.8			FDI
CA_8A-42C ^{14,15}	42 ¹⁸			-84.8	-84.7	-84.6	-84.5	TDE
	26			N/A	N/A	N/A	3 1.0	FDE
CA_26A-41C ⁷	41			N/A	N/A	N/A	N/A	TDE
	28			-60.7	-60.7	-60.7	-60.7	FDD
CA_28A-40C ^{16,17}			i		00.7	00.7		UL

CA 28A-40D ^{16,17}	28		-60.7	-60.7	-60.7	-60.7	FDD
CA_26A-40D***	40		-100	-97	-95.2	-94	TDD
CA 28A-42C ^{12,13}	28		-98.3	-95.3	-93.5	-92.3	FDD
CA_20A-42C,13	42 ¹⁸		-85.7	-85.4	-85.1	-84.9	TDD

- NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: The signal power is specified per port
- NOTE 4: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).
- NOTE 5: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of a high band.
- NOTE 6: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that $f_{UL}^{LB} = \left \lfloor f_{DL}^{HB} / 0.3 \right \rfloor 0.1 \text{ in MHz and } F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL_high}^{LB} BW_{Channel}^{LB} / 2 \text{ with } f_{DL}^{HB} \text{ the carrier frequency of a high band in MHz and } BW_{Channel}^{LB} \text{ the channel bandwidth configured in the low band}$
- NOTE 7: No requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the low band for which the 3rd transmitter harmonic is within the downlink transmission bandwidth of the high band. The reference sensitivity is only verified when this is not the case (the requirements specified in clause 7.3.1 apply).
- NOTE 8: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band and a range ΔF_{HD} above and below the edge of this downlink transmission bandwidth. The value ΔF_{HD} depends on the E-UTRA configuration: $\Delta F_{HD} = 10$ MHz for CA_3A-42C, CA_1A-3A-19A-42C, CA_1A-3A-42C and CA_3A-19A-42C.
- MHz for CA_3A-42C, CA_1A-3A-19A-42C, CA_1A-3A-42C and CA_3A-19A-42C. NOTE 9: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \left \lfloor f_{DL}^{HB} / 0.2 \right \rfloor 0.1$ in MHz and $F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \le f_{UL}^{LB} \le F_{UL_high}^{LB} BW_{Channel}^{LB} / 2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.
- NOTE 10: The requirements are only applicable to channel bandwidths with a carrier frequency at $\pm \left(20 + BW_{Channel}^{HB} / 2\right)$ MHz offset from $2f_{UL}^{LB}$ in the victim (higher band) with $F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \le f_{UL}^{LB} \le F_{UL_high}^{LB} BW_{Channel}^{LB} / 2$, where $BW_{Channel}^{LB}$ are the channel bandwidths configured in the aggressor (lower) and victim (higher) bands in MHz, respectively.
- NOTE 11: Void
- NOTE 12: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 5th transmitter harmonic is within the downlink transmission bandwidth of a high band.
- NOTE 13: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that $f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} = \left\lfloor f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} / 0.5 \right\rfloor 0.1 \, \text{in MHz and} \,\, F_{\scriptscriptstyle UL_low}^{\scriptscriptstyle LB} + BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \le f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} \le F_{\scriptscriptstyle UL_high}^{\scriptscriptstyle LB} BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \,\, \text{with} \, f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} \,\, \text{the carrier frequency of a high band in MHz and} \,\, BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} \,\, \text{the channel bandwidth configured in the low band}$
- NOTE 14: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 4th transmitter harmonic is within the downlink transmission bandwidth of a high band.
- NOTE 15: The requirements should be verified for UL EARFCN of a low band (superscript LB) such that $f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} = \left\lfloor f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} / 0.4 \right\rfloor 0.1 \, \text{in MHz and} \, F_{\scriptscriptstyle UL_low}^{\scriptscriptstyle LB} + BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \le f_{\scriptscriptstyle UL}^{\scriptscriptstyle LB} \le F_{\scriptscriptstyle UL_high}^{\scriptscriptstyle LB} BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} / 2 \, \text{ with } f_{\scriptscriptstyle DL}^{\scriptscriptstyle HB} \, \text{ the carrier frequency of a high band in MHz and} \, BW_{\scriptscriptstyle Channel}^{\scriptscriptstyle LB} \, \text{ the channel bandwidth configured in the low band.}$
- NOTE 16: These requirements apply when there is at least one individual RE within the downlink transmission bandwidth of the victim (lower) band for which the 3rd harmonic is within the uplink transmission bandwidth or the uplink adjacent channel's transmission bandwidth of an aggressor (higher) band.
- NOTE 17: The requirements should be verified for UL EARFCN of the aggressor (higher) band (superscript HB) such that $f_{DL}^{LB} = \left \lfloor f_{UL}^{HB} / 0.3 \right \rfloor 0.1$ in MHz and $F_{UL_low}^{LB} + BW_{Channel}^{LB} / 2 \le f_{UL}^{LB} \le F_{UL_high}^{LB} BW_{Channel}^{LB} / 2$ with f_{DL}^{LB} the carrier frequency in the victim (lower) band and $BW_{Channel}^{HB}$ the channel bandwidth configured in the higher band.
- NOTE 18: Applicable for the operations with 2 or 4 antenna ports supported in the band with carrier aggregation configured.

Table 7.3.1A-6: Uplink configuration for the low band (exceptions due to harmonic issues in the combinations of intra-band and inter-band CA)

E-UTRA B	E-UTRA Band / Channel bandwidth of the high band / N _{RB} / Duplex mode												
EUTRA CA Configuration	UL band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duple x mode					
CA_1A-3A-7C-28A	28				16	25	25	FDD					
CA_1A-3A-19A-42C	3			12	25	36	50	FDD					
CA_1A-3A-42C	3			12	25	36	50	FDD					
CA_1A-7C-28A	28				16	25	25	FDD					
CA_2A-2A-4A-12A	12			8	16	20	20	FDD					
CA_2A-4A-4A-12A	12			8	16	20	20	FDD					
CA_3A-19A-42C	3			12	25	36	50	FDD					
CA_3A-28A-40C	40			25	50	75	100	TDD					
CA_3A-42C	3			12	25	36	50	FDD					
CA_4A-4A-5A-12A	12			8	16	20	20	FDD					
CA_4A-4A-12A	12			8	16	20	20	FDD					
CA_4A-4A-12A-30A	12			8	16	20	20	FDD					
CA_4A-12B	12			8	16	20	20	FDD					
CA_8A-42C	8			8	16	25	25	FDD					
CA_28A-40C	40			25	50	75	100	TDD					
CA_28A-40D	40			25	50	75	100	TDD					
CA_28A-42C	28			5	10	15	20	FDD					

NOTE 1: refers to the UL resource blocks, which shall be centred within the transmission bandwidth configuration for the channel bandwidth.

NOTE 2: the UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.1-2 for the uplink bandwidth in which case the allocation according to Table 7.3.1-2 applies.

7.3.1B Minimum requirements (QPSK) for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.3.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P_{UMAX} is the total transmitter power over the two transmits power over the two transmit antenna connectors.

7.3.1D Minimum requirements (QPSK) for ProSe

When UE is configured for E-UTRA ProSe reception non-concurrent with E-UTRA uplink transmissions for E-UTRA ProSe operating bands specified in Table 5.5D-1, the throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.6.2 with parameters specified in Table 7.3.1D-1 and Table 7.3.1D-2.

Table 7.3.1D-1: Reference sensitivity for ProSe Direct Discovery QPSK PREFSENS

		C	hannel bar	ndwidth			
E-UTRA ProSe Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
2			-104.1	-104.1	-104.1	-104.1	HD
3			-103.1	-103.1	-103.1	-103.1	HD
4			-106.1	-106.1	-106.1	-106.1	HD
7			-103.8	-103.8	-103.8	-103.8	HD
14			-103.1	-103.1			HD
20			-103.2	-103.2	-102.2	-102.2	HD
26			-103.5 ⁵	-103.5 ⁵	-103.5 ⁵		HD
28			-104.4	-104.4	-104.4	-102.9	HD
31			-99.5				HD
68			-104.4	-104.4	-104.4		HD

- NOTE 1: Reference measurement channel is A.6.2
- NOTE 2: The signal power is specified per port
- NOTE 3: For the UE which supports both Band 3 and Band 9 the reference sensitivity level is FFS.
- NOTE 4: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.
- NOTE 5: ⁵ indicates that the requirement is modified by -0.5 dB when the carrier frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.
- NOTE 6: For a UE that support both Band 18 and Band 26, the reference sensitivity level for Band 26 applies for the applicable channel bandwidths.

Table 7.3.1D-2: Reference sensitivity for ProSe Direct Communication QPSK PREFSENS

Channel bandwidth							
E-UTRA ProSe Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
3				-97.6			HD
7				-98.3			HD
14				-97.6			HD
20				-97.7			HD
26				-98.0 ⁵			HD
28				-98.9			HD
31			-96.7				HD
68			-101.7	-98.9			HD

NOTE 1: Reference measurement channel is A.6.2

NOTE 2: The signal power is specified per port

NOTE 3: For the UE which supports both Band 3 and Band 9 the reference sensitivity level is FFS.

NOTE 4: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.

NOTE 5: 5 indicates that the requirement is modified by -0.5 dB when the carrier

frequency of the assigned E-UTRA channel bandwidth is within 865-894 MHz.

NOTE 6: For a UE that support both Band 18 and Band 26, the reference sensitivity level for Band 26 applies for the applicable channel bandwidths.

NOTE: Table 7.3.1D-1/ Table 7.3.1D-2 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of allocated resource blocks will be practically constrained by other factors.

For the UE which supports ProSe in an operating band as specified in Section 5.5D, and the UE also supports a E-UTRA downlink inter-band carrier aggregation configuration in Table 7.3.1-1A or Table 7.3.1-1B, the minimum requirement for reference sensitivity in Table 7.3.1D-1 and Table 7.3.1D-2 shall be increased by the amount given in $\Delta R_{IB,c}$ in Table 7.3.1-1A and Table 7.3.1-1B for the corresponding E-UTRA ProSe band.

When UE is configured for E-UTRA ProSe reception on PCC for the inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, there are no further requirements for reference sensitivity beyond those specified above when only PCC is configured in Table 7.3.1D-1 and Table 7.3.1D-2.

When UE is configured for E-UTRA ProSe reception on SCC or a non-serving carrier concurrent with E-UTRA uplink for inter-band E-UTRA ProSe / E-UTRA bands specified in Table 5.5D-2, E-UTRA ProSe throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.6.2 with parameters specified in Table 7.3.1D-1 and Table 7.3.1D-2. The reference sensitivity is defined to be met with E-UTRA uplink assigned to one band (that differs from the ProSe operating band) and all E-UTRA downlink carriers active. The E-UTRA uplink resource blocks shall be located as close as possible to E-UTRA ProSe operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1). The uplink configuration for the E-UTRA operating band is specified in Table 7.3.1D-3.

NOTE: The E-UTRA uplink channel bandwidth and transmission bandwidth specified in this Table 7.3.1D-3 are intended for conformance tests and does not restrict the operating conditions of the network.

Table 7.3.1D-3: Uplink configuration for E-UTRA band / E-UTRA CA band

Inter-band E-UT	E-UTRA UL band / Channel BW / N _{RB} / Duplex mode				
E-UTRA ProSe band E-UTRA band E-UTRA CA band		E-UTRA Channel Bandwidth (MHz)		N _{RB}	Duplex Mode
2	4	4	5	25	FDD
2	CA_2-4	4	5	25	FDD
28	1	1	5	25	FDD
28	CA_1-28	1	5	25	FDD

NOTE 1: For E-UTRA ProSe reception on SCC, the channel bandwith of the E-UTRA downlink SCC is set same as the ProSe channel bandwidth for which reference sensitivity is being measured.

7.3.1E Minimum requirements (QPSK) for UE category 0 and M1

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.1E-1A/Table 7.3.1E-1B and Table 7.3.1E-2 for category 0 and Table 7.3.1E-3/Table 7.3.1E-4 for category M1.

Table 7.3.1E-1A: Reference sensitivity for FDD and TDD UE category 0 QPSK PREFSENS

	Channel bandwidth										
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode				
2	-100.2	-97.2	-95.5	-92.5	-90.7	-89.5	FDD				
3	-99.2	-96.2	-94.5	-91.5	-89.7	-88.5	FDD				
4	-102.2	-99.2	-97.5	-94.5	-92.7	-91.5	FDD				
5	-100.7	-97.7	-95.5	-92.5			FDD				
8	-99.7	-96.7	-94.5	-91.5			FDD				
13			-94	-91			FDD				
20			-94.5	-91.5	-88.2	-87	FDD				
39			-97.5	-94.5	-92.7	-91.5	TDD				
41			-95.5	-92.5	-90.7	-89.5	TDD				

NOTE 1: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.5

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG

Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

Table 7.3.1E-1B: Reference sensitivity for HD-FDD UE category 0 QPSK PREFSENS

	Channel bandwidth										
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode				
2	-101	-98	-96.3	-93.3	-91.5	-90.3	HD-FDD				
3	-100	-97	-95.3	-92.3	-90.5	-89.3	HD-FDD				
4	-103	-100	-98.3	-95.3	-93.5	-92.3	HD-FDD				
5	-101.5	-98.5	-96.3	-93.3			HD-FDD				
8	-100.5	-97.5	-95.3	-92.3			HD-FDD				
13			-95.3	-92.3			HD-FDD				
20			-95.3	-92.3	-89.5	-88.3	HD-FDD				

NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5

NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.1E-1A/Table 7.3.1E-1B shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.1E-2.

<u>Unless given by Table 7.3.1-3, the minimum requirements specified in Table 7.3.1E-1A/Table 7.3.1E-1B shall be verified with the network signalling value NS_01 (Table 6.2.4E-1) configured.</u>

NOTE: Table 7.3.1E-2 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of uplink and downlink allocated resource blocks will be practically constrained by other factors. Typical receiver sensitivity performance with HARQ retransmission enabled and using a residual BLER metric relevant for e.g. Speech Services is given in the Annex G (informative).

Table 7.3.1E-2: FDD and TDD UE category 0 Uplink configuration for reference sensitivity

	E-UTRA Band / Channel bandwidth / NRB / Duplex mode										
E-UTRA	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode				
Band											
2	6	15	25	36¹	36 ¹	36¹	FDD and HD-FDD				
3	6	15	25	36 ¹	36 ¹	36 ¹	FDD and HD-FDD				
4	6	15	25	36 ¹	36 ¹	36 ¹	FDD and HD-FDD				
5	6	15	25	25 ¹			FDD and HD-FDD				
8	6	15	25	25 ¹			FDD and HD-FDD				
13			20 ¹	20 ¹			FDD and HD-FDD				
20			25	20 ¹	20 ²	20 ²	FDD and HD-FDD				
39			25	36 ¹	36 ¹	36 ¹	TDD				
41			25	36 ¹	36 ¹	36 ¹	TDD				

NOTE 1: ¹ refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

NOTE 2: ² refers to Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 16.

Table 7.3.1E-3: Reference sensitivity for FDD and TDD UE category M1 QPSK PREFSENS

E-UTRA Band	REFSENS (dBm)	Duplex Mode
1	-102.2	FDD
2	-100.2	FDD
3	-99.2	FDD
4	-102.2	FDD
5	-100.7	FDD
7	-100.2	FDD
8	-99.7	FDD
11	-102.2 ³	FDD
12	-99.2	FDD
13	-98.7	FDD
18	-102.2 ⁴	FDD
19	-102.2	FDD
20	-99.7	FDD
21	-102.2 ³	FDD
26	-100.2	FDD
27	-100.7	FDD
28	-100.7	FDD
31	-96.5	FDD
39	-103.7	TDD
41	-101.7	TDD

- NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5
- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.
- NOTE 4: For a UE that support both Band 18 and Band 26, the reference sensitivity level for Band 26 applies for the applicable channel bandwidths.
- NOTE 5: For cat M1 the same reference sensitivity requirement applies for all applicable channel bandwidths (Table 5.6.1-1)
- NOTE 6: The reference receive sensitivity shall be met for an uplink transmission bandwidth less than or equal to 6 RB except for band 31. For band 31; in the case of 3 MHz channel bandwidth 5 RB applies and the UL resource blocks shall be located at RB_{start} 9. In case of 5 MHz channel bandwidth 5 RB applies and the UL resource blocks shall be located at RB_{start} 10.
- NOTE 7: The UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth.

Table 7.3.1E-4: Reference sensitivity for HD-FDD UE category M1 QPSK PREFSENS

E-UTRA Band	REFSENS (dBm)	Duplex Mode						
1	-103	HD-FDD						
2	-101	HD-FDD						
3	-100	HD-FDD						
4	-103	HD-FDD						
5	-101.5	HD-FDD						
7	-101	HD-FDD						
8	-100.5	HD-FDD						
11	-103 ³	HD-FDD						
12	-100	HD-FDD						
13	-100	HD-FDD						
18	-103 ⁴	HD-FDD						
19	-103	HD-FDD						
20	-100.5	HD-FDD						
21	-103 ³	HD-FDD						
26	-101	HD-FDD						
27	-101.5	HD-FDD						
28	-101.5	HD-FDD						
31	-97.3	HD-FDD						
NOTE 1: The transmitter shall be set to Pumax as defined in subclause 6.2.5								

- NOTE 2: Reference measurement channel is A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1
- NOTE 3: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.
- NOTE 4: For a UE that support both Band 18 and Band 26, the reference sensitivity level for Band 26 applies for the applicable channel bandwidths.
- NOTE 5: For cat M1 the same reference sensitivity requirement applies for all applicable channel bandwidths (Table 5.6.1-1)

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.1E-3/Table 7.3.1E-4 shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.1E-5.

Table 7.3.1E-5 is intended for conformance tests and does not necessarily reflect the operational conditions of the network, where the number of uplink and downlink allocated resource blocks will be practically constrained by other factors. Typical receiver sensitivity performance with HARQ retransmission enabled and using a residual BLER metric relevant for e.g. Speech Services is given in the Annex G (informative).

Table 7.3.1E-5: FDD and TDD UE category M1 Uplink configuration for reference sensitivity

E-UTRA Band	N _{RB}	Duplex Mode
1	6 ¹	FDD and HD-FDD
2	6 ¹	FDD and HD-FDD
3	6 ¹	FDD and HD-FDD
4	6 ¹	FDD and HD-FDD
5	6 ¹	FDD and HD-FDD
7	6 ¹	FDD and HD-FDD
8	6 ¹	FDD and HD-FDD
11	6 ¹	FDD and HD-FDD
12	6 ¹	FDD and HD-FDD
13	6 ¹	FDD and HD-FDD
18	6 ¹	FDD and HD-FDD
19	6 ¹	FDD and HD-FDD
20	6 ¹	FDD and HD-FDD
21	6 ¹	FDD and HD-FDD
26	6 ¹	FDD and HD-FDD
27	6 ¹	FDD and HD-FDD
28	6 ¹	FDD and HD-FDD
31	6 ¹	FDD and HD-FDD
•••		
39	6 ¹	TDD
41	6 ¹	TDD

NOTE 1: ¹ refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.6-1).

7.3.1F Minimum requirements for UE category NB1

7.3.1F.1 Reference sensitivity for UE category NB1

The category NB1 UE throughput shall be \geq 95% of the maximum throughput of the reference measurement channel as specified in Annex A.3.2 with received signal level as specified in Table 7.3.1F.1-1. Requirement in Table 7.3.1F.1-1 applies for any uplink configuration.

Table 7.3.1F.1-1: Reference sensitivity for UE category NB1

Operating band	REFSENS [dBm]
1, 2, 3, 5, 8, 12, 13, 17, 18, 19, 20, 26, 28, 66	- 108.2

7.3.1F.2 Void

7.3.2 Void

7.4 Maximum input level

This is defined as the maximum mean power received at the UE antenna port, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel.

7.4.1 Minimum requirements

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Units Channel bandwidth Rx Parameter 1.4 3 15 20 MHz MHz MHz MHz MHz MHz Power in Transmission -25^{2} dBm **Bandwidth Configuration** -27³

Table 7.4.1-1: Maximum input level

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.
- NOTE 2: Reference measurement channel is Annex A.3.2: 64QAM, R=3/4 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: Reference measurement channel is Annex A.3.2: 256QAM, R=4/5 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

7.4.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the maximum input level is defined with the uplink active on the band(s) other than the band whose downlink is being tested. For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part, the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. The UE shall meet the requirements specified in subclause 7.4.1 for each component carrier while all downlink carriers are active.

For intra-band contiguous carrier aggregation maximum input level is defined as the powers received at the UE antenna port over the Transmission bandwidth configuration of each CC, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel over each component carrier.

The downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.4.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels over each component carrier as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.1A-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Table 7.4.1A-1.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, each larger than or equal to 5 MHz, the maximum input level requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in Table 7.4.1-1 and Table 7.4.1A-1 for one component carrier and two component carriers per sub-block, respectively. The throughput of each downlink component carrier shall be \geq 95% of the maximum throughput of the specified reference measurement channel as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1). The requirements apply with all downlink carriers active.

20

MHz

-22

Rx Parameter	Units		CA Bandwidth Class					
		Α	В	С	D	E	F	
Power in largest			-28 ²	-25 ²	-25 ²	-26 ²		
Transmission Bandwidth Configuration CC	dBm		-30 ³	-27 ³	-27 ³	[-28] ³		
Power in each other CC			-28+	-25 +	-25 +	-26 +		
			10log(N _{RB,c}	10log(N _{RB,c}	10log(N _{RB,c}	10log(N _{RB,c}		
			/N _{RB,largest}	/N _{RB,largest}	/N _{RB,largest}	/N _{RB,largest}		
	dBm		вw) ²	вw) ²	вw) ²	вw) ²		
	ubiii		-30+	-27 +	-27 +	[-28] +		
			10log(N _{RB,c}	10log(N _{RB,c}	10log(N _{RB,c}	10log(N _{RB,c}		
			/N _{RB,largest}	/N _{RB,largest}	/N _{RB,largest}	/N _{RB,largest}		
			_{D\\} \) 3	_{DM}) 3	_{DM}) 3	_{DW}) 3		

Table 7.4.1A-1: Maximum input level for intra-band contiguous CA

NOTE 1: The transmitter shall be set to 4dB below PcMAX_L,c or PcMAX_L as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is Annex A.3.2: 64QAM, R=3/4 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

NOTE 3: Reference measurement channel is Annex A.3.2: 256QAM, R=4/5 variant with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguous sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink assigned to one E-UTRA band, the requirement is defined with the uplink active in a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For these uplink configurations, the UE shall meet the maximum input-level requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the the requirements specified in subclause 7.4.1. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

7.4.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing, the minimum requirements in Clause 7.4.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter $P_{\text{CMAX_L}}$ is defined as the total transmitter power over the two transmit antenna connectors.

7.4.1D Minimum requirements for ProSe

Power in Transmission

Bandwidth Configuration

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.6.2.

Rx Parameter Units Channel bandwidth

1.4 3 5 10 15

MHz MHz MHz MHz MHz MHz

dBm

Table 7.4.1D-1: Maximum input level for ProSe

7.4.1F Minimum requirements for category NB1

NOTE 1: Reference measurement channel is Annex A.6.2

Category NB1 UE maximum input level requirement is -25 dBm. For this input level the throughput shall be $\ge 95\%$ of the maximum throughput of the reference measurement channel as specified in Annex A.3.2.

7.4A Void

7.4A.1 Void

7.5 Adjacent Channel Selectivity (ACS)

Adjacent Channel Selectivity (ACS) is a measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

7.5.1 Minimum requirements

The UE shall fulfil the minimum requirement specified in Table 7.5.1-1 for all values of an adjacent channel interferer up to -25 dBm. However it is not possible to directly measure the ACS, instead the lower and upper range of test parameters are chosen in Table 7.5.1-2 and Table 7.5.1-3 where the throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Table 7.5.1-1: Adjacent channel selectivity

		Channel bandwidth					
Rx Parameter	Units	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
ACS	dB	33.0	33.0	33.0	33.0	30	27

Table 7.5.1-2: Test parameters for Adjacent channel selectivity, Case 1

Rx Parameter	Units	Units Channel bandwidth						
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
Power in	dBm							
Transmission Bandwidth Configuration			REFSENS + 14 dB					
	dBm	REFSENS	REFSENS	REFSENS	REFSENS	REFSENS	REFSENS	
P _{Interferer}		+45.5dB	+45.5dB	+45.5dB	+45.5dB	+42.5dB	+39.5dB	
BWInterferer	MHz	1.4	3	5	5	5	5	
F _{Interferer} (offset)	MHz	1.4+0.0025 /	3+0.0075 /	5+0.0025 /	7.5+0.0075 /	10+0.0125 /	12.5+0.0025 /	
		-1.4-0.0025	-3-0.0075	-5-0.0025	-7.5-0.0075	-10-0.0125	-12.5- 0.0025	

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.
- NOTE 3: The REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.
- NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3.1E-3 should be used as REFSENS for the power in Transmission Bandwidth Configuration and P_{Interferer}.
- NOTE5: For DL category M1 UE, the parameters for the applicable channel bandwidth apply.

MHz

Finterferer (offset)

10+0.0125

-10-0.0125

12.5+0.0025

-12.5-0.0025

Units Channel bandwidth Rx Parameter 1.4 MHz 3 MHz 10 MHz 15 MHz 20 MHz 5 MHz Power in Transmission dBm -56.5 -56.5 -56.5 -56.5 -53.5-50.5 Bandwidth Configuration dBm PInterferer -25 BWInterferer MHz 5 1.4 3 5 5 5

5+0.0025

-5-0.0025

7.5+0.0075

-7.5-0.0075

Table 7.5.1-3: Test parameters for Adjacent channel selectivity, Case 2

NOTE 1: The transmitter shall be set to 24dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.

3+0.0075

-3-0.0075

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.

7.5.1A Minimum requirements for CA

1.4+0.0025

-1.4-0.0025

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band, the adjacent channel requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.5.1 for each component carrier while all downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink operation or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For a component carrier configured in Band 46, the requirements specified in subclause 7.5.1 are replaced by the requirements in Table 7.5.1A-0a with test parameters in Table 7.5.1A-0b and Table 7.5.1A-0c.

Table 7.5.1A-0a: Adjacent channel selectivity

E-UTRA band	Rx Parameter	Units		(Channel b	andwidth	1	
			1.4 3 5 10 15 MHz MHz MHz MHz MHz				20 MHz	
			IVITIZ	IVITIZ	IVITIZ	IVITIZ	IVITIZ	IVITIZ
46	ACS	dB						27

Table 7.5.1A-0b: Test parameters for Adjacent channel selectivity, Case 1

E-UTRA Band	Rx	Units	Channel bandwidth						
	Parameter		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
Power in dBm Transmission Bandwidth Configuration dBm REFSENS + 14 dB									
46	P _{Interferer}	dBm						REFSENS +39.5dB	
	BWInterferer	MHz						20	
	F _{Interferer} (offset)	MHz						20+0.0025 / -20-0.0025	

NOTE 1: In a band capable of uplink operation, the transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in Annex A.5.1.1/A.5.2.1/A.5.4.1 and set-up according to Annex C.3.1.

Table 7.5.1A-0c: Test parameters for Adjacent channel selectivity, Case 2

E-UTRA band	Rx	Units		Channel bandwidth						
	Parameter		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
	Power in Transmission Bandwidth Configuration	dBm						-50.5		
46	PInterferer	dBm			-2	25				
	BWInterferer	MHz						20		
	F _{Interferer} (offset)	MHz						20+0.0025 / -20-0.0025		

NOTE 1: In a band capable of unplink operation, the transmitter shall be set to 24dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in Annex A.5.1.1/A.5.2.1/A.5.4.1 and set-up according to Annex C.3.1.

For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the adjacent channel requirements of subclause 7.5.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.5.1A-2 and Table 7.5.1A-3 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement specified in Table 7.5.1A-1 for an adjacent channel interferer on either side of the aggregated downlink signal at a specified frequency offset and for an interferer power up to -25 dBm. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5.1A-2 and 7.5.1A-3. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.5.1A-2 and 7.5.1A-3.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, each larger than or equal to 5 MHz, the adjacent channel selectivity requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.5.1 and 7.5.1A for one component carrier and two component carriers per sub-block, respectively. The UE shall fulfil the minimum requirements all values of a single adjacent channel interferer in-gap and out-of-gap up to a –25 dBm interferer power while all downlink carriers are active. For the lower range of test parameters (Case 1), the interferer power P_{interferer} shall be set to the maximum of the levels given by the carriers of the respective sub-blocks as specified in Table 7.5.1-2 and Table 7.5.1A-2 for one component carrier and two component carriers per sub-block, respectively. The wanted signal power levels for the carriers of each sub-block shall then be adjusted relative to P_{interferer} in accordance with the ACS requirement for each sub-block (Table 7.5.1-1 and Table 7.5.1A-1). For the upper range of test parameters (Case 2) for which the interferer power P_{interferer} is -25 dBm (Table 7.5.1-3 and Table 7.5.1A-3) the wanted signal power levels for the carriers of each sub-block shall be adjusted relative to P_{interferer} like for Case 1.

Table 7.5.1A-1: Adjacent channel selectivity

		CA Bandwidth Class								
Rx Parameter	Units	В	С	D	E	F				
ACS	dB	27	24	22.2	21					

Table 7.5.1A-2: Test parameters for Adjacent channel selectivity, Case 1

Rx Parameter Unit		CA Bandwidth Class								
		В	С	D	E	F				
Pw in Transmission Bandwidth		REFSENS	REFSENS	REFSEN	REFSENS					
Configuration, per CC		+ 14 dB	+ 14 dB	S + 14 dB	+ 14 dB					
	dBm	Aggregated	Aggregated	Aggregat	Aggregate					
		power +	power +	ed power	d power +					
Pinterferer		25.5 dB	22.5 dB	+ 20.7 dB	19.5 dB					
BWInterferer	MHz	5	5	5	5					
F _{Interferer} (offset)	MHz		2.5 + F _{offset}	2.5 +	2.5 + F _{offset}					
		2.5 + F _{offset}	/	Foffset	/					
		/	-2.5 - Foffset	/	-2.5 - Foffset					
		-2.5 - F _{offset}		-2.5 -						
				Foffset						

- NOTE 1: The transmitter shall be set to 4dB below PCMAX_L,c or PCMAX_L as defined in subclause 6.2.5A.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1
- NOTE 3: The F_{interferer} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to $\left|F_{interferer}/0.015+0.5\right|0.015+0.0075\,\text{MHz}$ to be offset from the sub-carrier raster.

Table 7.5.1A-3: Test parameters for Adjacent channel selectivity, Case 2

Rx Parameter	Units	Units CA Bandwidth Class							
		В	С	D	E	F			
Pw in Transmission Bandwidth Configuration, per CC	dBm	-50.5 +10log ₁₀ (N _{RB,c} / N _{RB} _{agg})	-47.5 +10log ₁₀ (N _{RB} ,c/N _{RB} agg)	- 45.7+10log ₁₀ (N _{RB,c} /N _R _{B agg})	-44.5 +10log ₁₀ (N RB,c/NRB agg)				
P _{Interferer}	dBm			-25					
BWInterferer	MHz	5	5	5	5				
F _{Interferer} (offset)	MHz	2.5+ F _{offset} / -2.5- F _{offset}	2.5+ F _{offset} / -2.5- F _{offset}	2.5+ F _{offset} / -2.5- F _{offset}	2.5+ F _{offset} / -2.5- F _{offset}				

- NOTE 1: The transmitter shall be set to 24dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1
- NOTE 3: The F_{interferer} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to $|F_{interferer}|/0.015 + 0.5|0.015 + 0.0075$ MHz to be offset from the sub-carrier raster.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to four noncontiguously aggregated carriers per band and up to four contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in each band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For these uplink configurations, the UE shall meet the adjacent channel selectivity requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks with $\Delta R_{IBNC} = 0$ dB for all sub-block gaps (Table 7.3.1A-3) for the two non-contiguous downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.5.1. For contiguously aggregated component carriers configured in Band 46, the said requirements for intra-band contiguous carrier aggregation of downlink carriers are replaced by requirements in Table 7.5.1A-4 with test parameters in Table 7.5.1A-5 and Table 7.5.1A-6. All downlink carriers shall be active throughout the tests and the requirements for downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

Table 7.5.1A-4: Adjacent channel selectivity

E-UTRA band	Rx Parameter	Units	CA Bandwidth Class							
			B C D E							
46	ACS	dB		24	22.2	21				

Table 7.5.1A-5: Test parameters for Adjacent channel selectivity, Case 1

E-UTRA Band	Rx Parameter	Units	CA Bandwidth Class					
			В	С	D	E	F	
	Pw in Transmission Bandwidth Configuration, per CC	andwidth		REFSENS + 14 dB	REFSENS + 14 dB	REFSENS + 14 dB		
46	PInterferer	dBm		Aggregate d power + 22.5 dB	Aggregate d power + 20.7 dB	Aggregate d power + 19.5 dB		
	BWInterferer	MHz		20	20	20		
	FInterferer (offset)	MHz		10 + F _{offset} / -10 - F _{offset}	10 + F _{offset} / -10 - F _{offset}	10 + F _{offset} / -10 - F _{offset}		

- NOTE 1*: In a band capable of uplink operation, the transmitter shall be set to 4dB below PCMAX_L,c or PCMAX_L as defined in subclause 6.2.5A.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in Annex A.5.1.1/A.5.2.1/A.5.4.1 and set-up according to Annex C.3.1.
- NOTE 3: The $F_{\text{interferer}}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to $\left|F_{\text{interferer}}\right|/0.015+0.5 \left|0.015+0.0075\right|$ MHz to be offset from the sub-carrier raster.

Table 7.5.1A-6: Test parameters for Adjacent channel selectivity, Case 2

E-UTRA band	Rx Parameter	Units		CAI	Bandwidth Cl	ass	
			В	С	D	Е	F
	Pw in Transmission			-47.5	-45.7	-44.5	
	Bandwidth Configuration,	dBm		+10log10(NRB	+10log10(N	+10log10(N	
	per CC			,c/N _{RB agg})	$_{RB,c}/N_{RB agg}$	_{RB,c} /N _{RB agg})	
46	P _{Interferer}	dBm			-25		
40	BWInterferer	MHz		20	20	20	
	Finterferer (offset)	MHz		10 + F _{offset}	10 + F _{offset}	10 + F _{offset}	
				/	/	/	
				-10 - F _{offset}	-10 - F _{offset}	-10 - F _{offset}	

- NOTE 1: In a band capable of uplink operation, the transmitter shall be set to 24dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex 3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in Annex A.5.1.1/A.5.2.1/A.5.4.1 and set-up according to Annex C.3.1.
- NOTE 3: The $F_{interferer}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the adjacent channel interferer and shall be further adjusted to $F_{interferer} / 0.015 + 0.5 = 0.015 + 0.0075$ MHz to be offset from the sub-carrier raster.

7.5.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.5.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter PCMAX_L is defined as the total transmitter power over the two transmit antenna connectors.

7.5.1D Minimum requirements for ProSe

The UE shall fulfil the minimum requirement specified in Table 7.5.1D-1 for all values of an adjacent channel interferer up to -25 dBm. However it is not possible to directly measure the ACS, instead the lower and upper range of test

parameters are chosen in Table 7.5.1D-2 and Table 7.5.1D-3 where the throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2.

Table 7.5.1D-1: Adjacent channel selectivity for ProSe

		Channel bandwidth							
Rx Parameter	Units	1.4 3 5 10 15 20							
		MHz	MHz	MHz	MHz	MHz	MHz		
ACS	dB			33.0	33.0	30	27		

Table 7.5.1D-2: Test parameters for Adjacent channel selectivity for ProSe, Case 1

Rx Parameter	Units		Channel bandwidth									
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz					
Power in Transmission	dBm											
Bandwidth Configuration				P _{REFSENS_Pro}	_{Se} + 14 dB							
	dBm			REFSENS	REFSENS	REFSENS	REFSENS					
PInterferer				+45.5dB	+45.5dB	+42.5dB	+39.5dB					
BWInterferer	MHz			5	5	5	5					
Finterferer (offset)	MHz			5+0.0025	7.5+0.0075	10+0.0125	12.5+0.0025					
, ,				/	/	/	/					
				-5-0.0025	-7.5-0.0075	-10-0.0125	-12.5-					
							0.0025					

NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211.

Table 7.5.1D-3: Test parameters for Adjacent channel selectivity for ProSe, Case 2

Rx Parameter	Units			Channel b	andwidth		
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission Bandwidth Configuration	dBm			-56.5	-56.5	-53.5	-50.5
PInterferer	dBm			-2	5		
BW _{Interferer}	MHz			5	5	5	5
Finterferer (offset)	MHz			5+0.0025 / -5-0.0025	7.5+0.0075 / -7.5-0.0075	10+0.0125 / -10-0.0125	12.5+0.0025 / -12.5- 0.0025

NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211.

7.5.1F Minimum requirements for category NB1

Category NB1 UE shall fulfil the minimum requirement specified in Table 7.5.1F-1 for all values of an adjacent channel interferer up to -25 dBm. However it is not possible to directly measure the ACS, instead the lower and upper range of test parameters are chosen in Table 7.5.1F-1 where the throughput shall be \geq 95% of the maximum throughput of the reference measurement channel as specified in Annex A.3.2.

ACS1 test Parameters E-UTRA Interferer **GSM (GMSK)** Category NB1 signal power REFSENS + 14 dB (Pwanted) / dBm Interferer signal power REFSENS + 42 dB REFSENS + 47 dB (P_{Interferer}) / dBm 200 kHz 5 MHz Interferer bandwidth Interferer offset from category NB1 channel edge ±200 kHz ±2.5 MHz **ACS2 test Parameters GSM (GMSK)** E-UTRA Interferer Category NB1 signal power -53 dBm -58 dRm (P_{wanted}) / dBm Interferer signal power -25 dBm (PInterferer) / dBm Interferer bandwidth 200 kHz 5 MHz Interferer offset from category NB1 channel edge ±200 kHz ±2.5 MHz

Table 7.5.1F: Adjacent channel selectivity parameters for category NB1

7.6 Blocking characteristics

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

7.6.1 In-band blocking

In-band blocking is defined for an unwanted interfering signal falling into the UE receive band or into the first 15 MHz below or above the UE receive band at which the relative throughput shall meet or exceed the minimum requirement for the specified measurement channels.

For CA configurations including Band 46, in-band blocking in Band 46 is defined for a 20 MHz unwanted interfering signal falling into the UE receive band or into the first 60 MHz below or above the UE receive band (Table 7.6.1.1A-0a and Table 7.6.1.1A-0b).

7.6.1.1 Minimum requirements

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1-1 and 7.6.1.1-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Table 7.6.1.1-1: In band blocking parameters

Rx parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in			REFSENS	+ channel band	width specific v	alue below	
Transmission Bandwidth Configuration	dBm	6	6	6	6	7	9
BWInterferer	MHz	1.4	3	5	5	5	5
Floffset, case 1	MHz	2.1+0.0125	4.5+0.0075	7.5+0.0125	7.5+0.0025	7.5+0.0075	7.5+0.0125
Floffset, case 2	MHz	3.5+0.0075	7.5+0.0075	12.5+0.0075	12.5+0.012	12.5+0.002	12.5+0.007
					5	5	5

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.
- NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1.
- NOTE 3: The REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.
- NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3.1E-3 should be used as REFSENS for the power in Transmission Bandwidth Configuration.
- NOTE5: For DL category M1 UE, the parameters for the applicable channel bandwidth apply.

Table 7.6.1.1-2: In-band blocking

E-UTRA	Parameter	Unit	Case 1	Case 2	Case 3	Case 4	Case 5
band	PInterferer	dB m	-56	-44			-38
	F _{Interferer} (offset)	MH z	=-BW/2 - F _{loffset,case 1} & =+BW/2 + F _{loffset,case 1}	≤-BW/2 - Floffset,case 2 & ≥+BW/2 + Floffset,case 2			-BW/2 - 11
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 65, 66, 68	Finterferer	MHz	(NOTE 2)	F _{DL_low} – 15 to F _{DL_high} + 15	Void	Void	
30	F _{Interferer}	MHz	(NOTE 2)	F _{DL_low} – 15 to F _{DL_high} + 15			F _{DL_low} – 11

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

- a. the carrier frequency -BW/2 Floffset, case 1 and
- b. the carrier frequency +BW/2 + Floffset, case 1

NOTE 3: Finterferer range values for unwanted modulated interfering signal are interferer center frequencies

For the UE which supports inter band CA configuration in Table 7.3.1-1A, $P_{Interferer}$ power defined in Table 7.6.1.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.6.1.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the in-band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.1.1 for each component carrier while all downlink carriers are active. For the UE which supports inter band CA configuration in Table 7.3.1-1A, $P_{Interferer}$ power defined in Table 7.6.1.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A. For E-UTRA

CA configurations including an operating band without uplink operation or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. The requirements for the component carrier configured in the operating band without uplink operation are specified in Table 7.6.1.1A-0, Table 7.6.1.1A-0a and Table 7.6.1.1A-0b.

Table 7.6.1.1A-0: In-band blocking for additional operating bands for carrier aggregation

E-UTRA band	Parameter	Unit	Case 1	Case 2
	P _{Interferer}	dBm	-56	-44
	F _{Interferer} (offset)	MHz	=-BW/2 - Floffset,case 1 & =+BW/2 + Floffset,case 1	≤-BW/2 − F _{loffset,case 2} & ≥+BW/2 + F _{loffset,case 2}
29, 32, 67	FInterferer	MHz	(NOTE 2)	F _{DL_low} – 15 to F _{DL_high} + 15

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency -BW/2 - Floffset, case 1 and

b. the carrier frequency +BW/2 + Floffset, case 1

NOTE 3: Finterferer range values for unwanted modulated interfering signal are interferer center frequencies

Table 7.6.1.1A-0a: In band blocking parameters for additional operating bands for carrier aggregation

E-UTRA band	Rx parameter	Units	Channel bandwidth					
			1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
	Power in		REFSENS + channel bandwidth specific value below					
46	Transmission Bandwidth Configuration	dBm						9
(NOTE 3)	BWInterferer	MHz						20
	Floffset, case 1	MHz						30+0.0125
	Floffset, case 2	MHz						50+0.0075

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in Annex A.5.1.1/A.5.2.1/A.5.4.1 and set-up according to Annex C.3.1

NOTE 3: The interferer consists of the Reference measurement channel specified in Annex A.3.2 (TBD)

Table 7.6.1.1A-0b: In-band blocking for additional operating bands for carrier aggregation

E-UTRA band	Parameter	Unit	Case 1	Case 2
	P _{Interferer}	dBm	-50	-44
	E		=-BW/2 - Floffset,case 1	≤-BW/2 − F _{loffset,case 2}
	F _{Interferer} (offset)	MHz	&	&
	(UllSet)		=+BW/2 + Floffset,case 1	≥+BW/2 + Floffset,case 2
				F _{DL_low} – 60
46	F _{Interferer}	MHz	(Note 2)	to
				F _{DL_high} + 60

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz or 60 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency -BW/2 - $F_{\text{loffset, case 1}}$ and

b. the carrier frequency +BW/2 + Floffset, case 1

NOTE 3: F_{Interferer} range values for unwanted modulated interfering signal are interferer center frequencies

For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the in-band blocking requirements of subclause 7.6.1.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.6.1.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.1.1A-1 and Tables 7.6.1.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.1.1A-1 and 7.6.1.1A-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.6.2.1A-1 and 7.6.2.1A-2.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, each larger than or equal to 5 MHz, the in-band blocking requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclause 7.6.1.1 and in this subclause for one component carrier and two component carriers per sub-block, respectively. The requirements apply for in-gap and out-of-gap interferers while all downlink carriers are active.

Rx Parameter	Units		CA	A Bandwidth Cla	ISS					
		В	С	D	E	F				
Pw in Transmission		R	EFSENS + CA B	andwidth Class s	pecific value belo	W				
Bandwidth Configuration, per CC	dBm	9	12	13.8	15					
BW _{Interferer}	MHz	5	5	5	5					
Floffset, case 1	MHz	7.5	7.5	7.5	7.5					
Floffset_case 2	MHz	12.5	12.5	12.5	12.5					

Table 7.6.1.1A-1: In band blocking parameters

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1

CA configuration	Parameter	Unit	Case 1	Case 2
	PInterferer	dBm	-56	-44
	Finterferer		=-F _{offset} F _{loffset,case 1}	≤-F _{offset} - F _{loffset,case 2}
	(offset)	MHz	&	&
	(Oliset)		=+F _{offset} + F _{loffset,case 1}	≥+Foffset + Floffset,case 2
CA_1C, CA_2C, CA_3C, CA_5B, CA_7C, CA_8B, CA_12B, CA_23B, CA_27B, CA_38C, CA_39C, CA_40C, CA_41C, CA_40D, CA_41D, CA_42C, CA_42D, CA_42E, CA_66B, CA_66C	F _{Interferer} (Range)	MHz	(NOTE 2)	F _{DL_low} – 15 to F _{DL_high} + 15

Table 7.6.1.1A-2: In-band blocking

- NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band
- NOTE 2: For each carrier frequency the requirement is valid for two frequencies:
 - a. the carrier frequency F_{offset} $F_{\text{loffset, case 1}}$ and
 - b. the carrier frequency +Foffset + Floffset, case 1
- NOTE 3: F_{offset} is the frequency offset from the center frequency of the CC being tested to the edge of aggregated channel bandwidth.
- NOTE 4: The F_{interferer} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to $\left[F_{\text{interferer}}/0.015+0.5\right]0.015+0.0075$ MHz to be offset from the sub-carrier raster.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in the band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a

band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For these uplink configurations, the UE shall meet the in-band blocking requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks with $\Delta R_{IBNC} = 0$ dB for all sub-block gaps (Table 7.3.1A-3) for the two non-contiguous downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.6.1. For contiguously aggregated component carriers configured in Band 46, the said requirements for intraband contiguous carrier aggregation of downlink carriers are replaced by requirements in Table 7.6.1.1A-3 and 7.6.1.1A-4. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of uplink operation.

Table 7.6.1.1A-3: In band blocking parameters

E-UTRA Band	Rx Parameter	CA Bandwidth Class					
			В	С	D	E	F
	Pw in Transmission		REF	SENS + CA B	andwidth Class	specific value b	oelow
40	Bandwidth Configuration, per CC	dBm		12	13.8	15	
46	BWInterferer	MHz		20	20	20	
	Floffset, case 1	MHz		30	30	30	
	Floffset, case 2	MHz		50	50	50	

NOTE 1: In a band capable of uplink operation, the transmitter shall be set to 4dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A

NOTE 2: The interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in Annex A.5.1.1/A.5.2.1/A.5.4.1 and set-up according to Annex C.3.1

Table 7.6.1.1A-4: In-band blocking

E-UTRA Band	Parameter	Unit	Case 1	Case 2
	P _{Interferer}	dBm	-50	-44
	F _{Interferer} (offset)	MHz	=-Foffset-Floffset,case 1 & =+Foffset + Floffset,case 1	≤-F _{offset} — F _{loffset,case 2} & ≥+F _{offset} + F _{loffset,case 2}
46	F _{Interferer} (Range)	MHz	(Note 2)	F _{DL_low} – 60 to F _{DL_high} + 60

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency -Foffset - Floffset, case 1 and

b. the carrier frequency +Foffset + Floffset, case 1

NOTE 3: F_{offset} is the frequency offset from the center frequency of the CC being tested to the edge of aggregated channel bandwidth.

NOTE 4: The F_{interferer} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to $\left|F_{interferer}/0.015 + 0.5\right|0.015 + 0.0075$ MHz to be offset from the sub-carrier raster.

7.6.1.1D Minimum requirements for ProSe

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2.

Table 7.6.1.1D-1: In band blocking parameters for ProSe Direct Discovery

Rx parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in		PR	REFSENS_ProSe +	channel bandwid	dth specific val	ue below + Pof	fset
Transmission Bandwidth Configuration	dBm			6	6	7	9
BWInterferer	MHz			5	5	5	5
Floffset, case 1	MHz			7.5+0.0125	7.5+0.0025	7.5+0.0075	7.5+0.0125
Floffset, case 2	MHz			12.5+0.0075	12.5+0.012	12.5+0.002	12.5+0.007
					5	5	5
Poffset	dB			10.9	13.9	15.7	16.9

NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211

Table 7.6.1.1D-2: In band blocking parameters for ProSe Direct Communication

Rx parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in			Prefsens_pros	se + channel ban	dwidth specific	value below	
Transmission Bandwidth Configuration	dBm			6	6	7	9
BWInterferer	MHz			5	5	5	5
Floffset, case 1	MHz			7.5+0.0125	7.5+0.0025	7.5+0.0075	7.5+0.0125
Floffset, case 2	MHz			12.5+0.0075	12.5+0.012	12.5+0.002	12.5+0.007
					5	5	5

NOTE 1: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211

Table 7.6.1.1D-3: In-band blocking for ProSe

E-UTRA	Parameter	Unit	Case 1	Case 2
ProSe	P _{Interferer} dBm		P _{Interferer} dBm -56	
band	E		=-BW/2 - Floffset,case 1	≤-BW/2 − F _{loffset,case 2}
	F _{Interferer} (offset)	MHz	&	&
	(Oliset)		=+BW/2 + Floffset,case 1	≥+BW/2 + Floffset,case 2
2,3,4,7,14,				F _{DL_low} – 15
20,26,28,31	F _{Interferer}	MHz	(NOTE 2)	to
20,20,20,31				F _{DL_high} + 15

NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band

NOTE 2: For each carrier frequency the requirement is valid for two frequencies:

a. the carrier frequency -BW/2 - $F_{loffset, case\ 1}$ and

b. the carrier frequency +BW/2 + Floffset, case 1

NOTE 3: F_{Interferer} range values for unwanted modulated interfering signal are interferer center frequencies

For the UE which supports inter band CA configuration in Table 7.3.1-1A, $P_{Interferer}$ power defined in Table 7.6.1.1D-3 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.6.1.1F Minimum requirements for category NB1

Category NB1 UE throughput shall be \geq 95% of the maximum throughput of the reference measurement channel as specified in Annex A.3.2 with parameters specified in Table 7.6.1.1F-1.

IBB1 test Paramete	ers		
Category NB1 signal power (P _{wanted}) / dBm	REFSENS + 6 dB		
Interferer	E-UTRA		
Interferer signal power (P _{Interferer}) / dBm	- 56 dBm		
Interferer bandwidth	5 MHz		
Interferer offset from category NB1 channel edge	+7.5 MHz + 0.005 MHz and -7.5 MHz - 0.005 MHz		
IBB2 test Paramete	ers		
Category NB1 signal power (P _{wanted}) / dBm	REFSENS + 6 dB		
Interferer	E-UTRA		
Interferer signal power (P _{Interferer}) / dBm	- 44 dBm		
Interferer bandwidth	5 MHz		
Interferer offset range from category NB1 channel edge	From +12.5 MHz to F _{DL_high} + 15 MHz and From -12.5 MHz to F _{DL_low} - 15 MHz		

Table 7.6.1.1F-1: In-band blocking parameters for category NB1

7.6.2 Out-of-band blocking

Out-of-band band blocking is defined for an unwanted CW interfering signal falling more than 15 MHz below or above the UE receive band. For the first 15 MHz below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in subclause 7.5.1 and subclause 7.6.1 shall be applied.

For CA configurations including Band 46, out-of-band band blocking is defined for an unwanted CW interfering signal falling more than 60 MHz below or above the UE receive band (see Table 7.6.2.1A-0a). For the first 60 MHz below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in subclause 7.5.1A and subclause 7.6.1A shall be applied.

7.6.2.1 Minimum requirements

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to $\max(24, 6 \cdot \lceil N_{RB} / 6 \rceil)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configuration (see Figure 5.6-1). For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to $\max(8, \lceil (N_{RB}+2\cdot L_{CRBs})/8 \rceil)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configurations (see Figure 5.6-1) and L_{CRBs} is the number of resource blocks allocated in the uplink. For these exceptions the requirements of clause 7.7 spurious response are applicable.

Table 7.6.2.1-1: Out-of-band blocking parameters

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in		REFS	ENS + ch	annel ban	dwidth sp	ecific valu	e below
Transmission	dBm						
Bandwidth	иын	6	6	6	6	7	9
Configuration							

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.
- NOTE 3: The REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.
- NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3.1E-3 should be used as REFSENS for the power in Transmission Bandwidth Configuration.
- NOTE5: For DL category M1 UE, the parameters for the applicable channel bandwidth apply.

Table 7.6.2.1-2: Out of band blocking

E-UTRA band	Parameter	Units		Fred	quency	
			Range 1	Range 2	Range 3	Range 4
	PInterferer	dBm	-44	-30	-15	-15
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,			F _{DL_low} -15 to F _{DL_low} -60	F _{DL_low} -60 to F _{DL_low} -85	F _{DL_low} -85 to 1 MHz	-
12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42 (NOTE 2), 43 (NOTE 2), 44, 45, 65, 66, 68	Finterferer (CW)	MHz	F _{DL_high} +15 to F _{DL_high} + 60	F _{DL_high} +60 to F _{DL_high} +85	F _{DL_high} +85 to +12750 MHz	-
2, 5, 12, 17	F _{Interferer}	MHz	-	-	-	Ful_low - Ful_hi (NOTE 4)

- NOTE 1: For the UE which supports both Band 11 and Band 21 the out of blocking is FFS.
- NOTE 2: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2800 MHz and $F_{Interferer}$ < 4400 MHz.
- NOTE 3: For the UE that supports both Band 4 and Band 66, the out-of-blocking frequency range for Band 4 is defined relative to F_{DL_low} and F_{DL_high} of Band 66.
- NOTE 4: Range 4 requirement does not apply to category M1.

7.6.2.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band, the out-of-band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The throughput in the downlink measured shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1-1 and 7.6.2.1A-0. For E-UTRA CA configurations including an operating band without uplink operation (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the uplink active in the band(s) capable of UL operation. For the E-UTRA CA configurations listed in Table 7.6.2.1A-0a, the parameters specified in Table 7.6.2.1A-0 are replaced by those specified in Table 7.6.2.1A-0a. The UE shall meet these requirements for each component carrier while all downlink carriers are active.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the out-of-band blocking requirements specified above shall be met with the transmitter power for the uplink set to 7 dB below $P_{CMAX_L,c}$ for each serving cell c.

For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the out-of-band blocking requirements of subclause 7.6.2.1A do not apply.

Table 7.6.2.1A-0: out-of-band blocking for inter-band carrier aggregation

$ \begin{array}{ c c c c } \hline P_{w} & dBm & Table 7.6.2.1-1 \ for \ all \ component \ carriers \\ \hline P_{interferer} & dBm & -44 + \Delta R_{IB,c} & -30 + \Delta R_{IB,c} & -15 + \Delta R_{IB,c} \\ \hline F_{interferer} & DR_{interferer} & DR_{in$	Paramete	er Unit	Range 1	Range 2	Range 3				
Finterferer (CW) MHz $-60 < f - F_{DL_Low(j)} < -15$ or $-85 < f - F_{DL_Low(j)} \le -60$ or $-60 \le f - F_{DL_High(j)} < 85$ or $-60 \le f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f - F_{DL_High(j)} < 85$ $-85 < f -$	Pw	dBm	Table 7.6	6.2.1-1 for all component ca	arriers				
CCW To the present version of this specification Component carriers in the band combination (X \leq 5 for the present version of this specification). NOTE 2: For FDL_Low(j+1) - FDL_High(j) < 145 MHz and FInterferer in FDL_High(j) < 15 FDL_Low(j+1) with $j < X$, FInterferer can be in both Range 1 and Range 2. Then the lower of the PInterferer applies. NOTE 3: For FDL_Low(j+1) - T5 MHz \leq f \leq FDL_High(j) + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier j . NOTE 4: Δ RIB,c according to Table 7.3.1-1A applies when serving cell c is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (PInterferer) for Range 3 modified to -20 + Δ RIB,c	Pinterferer	dBm	$-44 + \Delta R_{IB,c}$	-30 + ∆R _{IB,c}	-15 + ∆R _{IB,c}				
NOTE 1:	Finterferer	MHz	$-60 < f - F_{DL_Low(j)} < -15$	$-85 < f - F_{DL_Low(j)} \le -60$	$1 \le f \le F_{DL_Low(1)} - 85$				
NOTE 1: $F_{DL_Low(j)}$ and $F_{DL_High(j)}$ denote the respective lower and upper frequency limits of the operating band containing carrier j , $j=1,,X$, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination (X ≤ 5 for the present version of this specification). NOTE 2: For $F_{DL_Low(j+1)} - F_{DL_High(j)} < 145$ MHz and $F_{Interferer}$ in $F_{DL_High(j)} < f < F_{DL_Low(j+1)}$ with $j < X$, $F_{Interferer}$ can be in both Range 1 and Range 2. Then the lower of the $P_{Interferer}$ applies. NOTE 3: For $F_{DL_Low(j)} - 15$ MHz $\le f \le F_{DL_High(j)} + 15$ MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier j . NOTE 4: $\Delta R_{IB,c}$ according to Table 7.3.1-1A applies when serving cell c is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level ($P_{Interferer}$) for Range 3 modified to -20 + $\Delta R_{IB,c}$	(CW)		or	or	or				
 j < X or F_{DL_High(X)} + 85 ≤ f ≤ 12750 NOTE 1: F_{DL_Low(j)} and F_{DL_High(j)} denote the respective lower and upper frequency limits of the operating band containing carrier j, j = 1,,X, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination (X ≤ 5 for the present version of this specification). NOTE 2: For F_{DL_Low(j+1)} − F_{DL_High(j)} < 145 MHz and F_{Interferer} in F_{DL_High(j)} < f < F_{DL_Low(j+1)} with j < X, F_{Interferer} can be in both Range 1 and Range 2. Then the lower of the P_{Interferer} applies. NOTE 3: For F_{DL_Low(j)} − 15 MHz ≤ f ≤ F_{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier j. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell c is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 			$15 < f - F_{DL_High(j)} < 60$	$60 \le f - F_{DL_High(j)} < 85$	F _{DL_High(j)} + 85 ≤ f				
NOTE 1: F _{DL_Low(j)} and F _{DL_High(j)} denote the respective lower and upper frequency limits of the operating band containing carrier <i>j</i> , <i>j</i> = 1,,X, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination (X ≤ 5 for the present version of this specification). NOTE 2: For F _{DL_Low(j+1)} − F _{DL_High(j)} < 145 MHz and F _{Interferer} in F _{DL_High(j)} < f < F _{DL_Low(j+1)} with <i>j</i> < X, F _{Interferer} can be in both Range 1 and Range 2. Then the lower of the P _{Interferer} applies. NOTE 3: For F _{DL_Low(j)} − 15 MHz ≤ f ≤ F _{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier <i>j</i> . NOTE 4: ΔR _{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P _{Interferer}) for Range 3 modified to -20 + ΔR _{IB,c}					$\leq F_{DL_Low(j+1)} - 85$ with				
 NOTE 1: F_{DL_Low(j)} and F_{DL_High(j)} denote the respective lower and upper frequency limits of the operating band containing carrier <i>j</i>, <i>j</i> = 1,,X, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination (X ≤ 5 for the present version of this specification). NOTE 2: For F_{DL_Low(j+1)} − F_{DL_High(j)} < 145 MHz and F_{Interferer} in F_{DL_High(j)} < f < F_{DL_Low(j+1)} with <i>j</i> < X, F_{Interferer} can be in both Range 1 and Range 2. Then the lower of the P_{Interferer} applies. NOTE 3: For F_{DL_Low(j)} − 15 MHz ≤ f ≤ F_{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier <i>j</i>. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 					<i>j</i> < X				
 NOTE 1: F_{DL_Low(j)} and F_{DL_High(j)} denote the respective lower and upper frequency limits of the operating band containing carrier <i>j</i>, <i>j</i> = 1,,X, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination (X ≤ 5 for the present version of this specification). NOTE 2: For F_{DL_Low(j+1)} − F_{DL_High(j)} < 145 MHz and F_{Interferer} in F_{DL_High(j)} < f < F_{DL_Low(j+1)} with <i>j</i> < X, F_{Interferer} can be in both Range 1 and Range 2. Then the lower of the P_{Interferer} applies. NOTE 3: For F_{DL_Low(j)} − 15 MHz ≤ f ≤ F_{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier <i>j</i>. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 					or				
 NOTE 1: F_{DL_Low(j)} and F_{DL_High(j)} denote the respective lower and upper frequency limits of the operating band containing carrier <i>j</i>, <i>j</i> = 1,,X, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination (X ≤ 5 for the present version of this specification). NOTE 2: For F_{DL_Low(j+1)} − F_{DL_High(j)} < 145 MHz and F_{Interferer} in F_{DL_High(j)} < f < F_{DL_Low(j+1)} with <i>j</i> < X, F_{Interferer} can be in both Range 1 and Range 2. Then the lower of the P_{Interferer} applies. NOTE 3: For F_{DL_Low(j)} − 15 MHz ≤ f ≤ F_{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier <i>j</i>. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 					_ 0 ()				
 band containing carrier <i>j</i>, <i>j</i> = 1,,X, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination (X ≤ 5 for the present version of this specification). NOTE 2: For F_{DL_Low(j+1)} – F_{DL_High(j)} < 145 MHz and F_{Interferer} in F_{DL_High(j)} < f < F_{DL_Low(j+1)} with <i>j</i> < X, F_{Interferer} can be in both Range 1 and Range 2. Then the lower of the P_{Interferer} applies. NOTE 3: For F_{DL_Low(j)} – 15 MHz ≤ f ≤ F_{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier <i>j</i>. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 									
frequency and X the number of component carriers in the band combination (X ≤ 5 for the present version of this specification). NOTE 2: For F _{DL_Low(j+1)} − F _{DL_High(j)} < 145 MHz and F _{Interferer} in F _{DL_High(j)} < f < F _{DL_Low(j+1)} with <i>j</i> < X, F _{Interferer} can be in both Range 1 and Range 2. Then the lower of the P _{Interferer} applies. NOTE 3: For F _{DL_Low(j)} − 15 MHz ≤ f ≤ F _{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier <i>j</i> . NOTE 4: ΔR _{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P _{Interferer}) for Range 3 modified to -20 + ΔR _{IB,c}									
 present version of this specification). NOTE 2: For F_{DL_Low(j+1)} − F_{DL_High(j)} < 145 MHz and F_{Interferer} in F_{DL_High(j)} < f < F_{DL_Low(j+1)} with j < X, F_{Interferer} can be in both Range 1 and Range 2. Then the lower of the P_{Interferer} applies. NOTE 3: For F_{DL_Low(j)} − 15 MHz ≤ f ≤ F_{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier j. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell c is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 									
 NOTE 2: For F_{DL_Low(j+1)} − F_{DL_High(j)} < 145 MHz and F_{Interferer} in F_{DL_High(j)} < f < F_{DL_Low(j+1)} with j < X, F_{Interferer} can be in both Range 1 and Range 2. Then the lower of the P_{Interferer} applies. NOTE 3: For F_{DL_Low(j)} − 15 MHz ≤ f ≤ F_{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier j. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell c is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 			•	nt carriers in the band com	bination (X ≤ 5 for the				
Finterferer can be in both Range 1 and Range 2. Then the lower of the P _{Interferer} applies. NOTE 3: For F _{DL_Low(j)} − 15 MHz ≤ f ≤ F _{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier <i>j</i> . NOTE 4: ΔR _{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P _{Interferer}) for Range 3 modified to -20 + ΔR _{IB,c}	NOTE			, -	14 1 X				
 NOTE 3: For F_{DL_Low(j)} – 15 MHz ≤ f ≤ F_{DL_High(j)} + 15 MHz the appropriate adjacent channel selectivity and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier j. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell c is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 	NOTE 2:								
 and in-band blocking requirments in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier <i>j</i>. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 	NOTE O								
 applied for carrier <i>j</i>. NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 	NOTE 3:								
 NOTE 4: ΔR_{IB,c} according to Table 7.3.1-1A applies when serving cell <i>c</i> is measured. NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level (P_{Interferer}) for Range 3 modified to -20 + ΔR_{IB,c} 			• .	espective subclauses 7.5.1	A and 7.6.1.1A shall be				
NOTE 5: For inter-band CA combinations containing Bands 42 or 43, the interferer with respect to Band 42 or Band 43 shall have power level ($P_{Interferer}$) for Range 3 modified to -20 + $\Delta R_{IB,c}$	NOTE 4			a whon coming call a ic may	anura d				
Band 42 or Band 43 shall have power level ($P_{Interferer}$) for Range 3 modified to -20 + $\Delta R_{IB,c}$									
	NOTE 5.								
QDIII IOI Finterferer > 2000 IVIAZ ariu Finterferer < 4400 IVIAZ.					Odified to -20 + ARIB,c				
NOTE 6: For inter-band CA combinations containing Bands 7 and 38 simultaneously, for Finterferer	NOTE 6:				occupily for Ev.				
NOTE 6: For inter-band CA combinations containing Bands 7 and 38 simultaneously, for F _{Interferer} Bands 7 and 38 are considered as one single band as follows: F _{DL_Low} = 2570 MHz and	NOTE 6.								

Table 7.6.2.1A-0a: out-of-band blocking for inter-band carrier aggregation with one active uplink

 $F_{DL_High} = 2690$ MHz. For Range 2, the following applies for F_{DL_Low} : -95 < f - $F_{DL_Low} \le$ -60 or $60 \le f - F_{DL_High} < 85$. For Range 3 the following applies $1 \le f \le F_{DL_Low}$ -95 or $F_{DL_High} + 85 \le f$

E-UTRA CA Configuration	Parameter	Unit	Range 1	Range 2	Range 3
CA 4A 4CA	Pwanted	dBm	Table 7.6	.2.1-1 for all component of	arriers
CA_1A-46A, CA_2A-46A, CA_3A-46A,	Pinterferer	dBm	-44 + ΔR _{IB,c}	-30 + ΔR _{IB,c}	-15 + ∆R _{IB,c} (NOTE 5)
CA_3A-46A, CA_4A-46A, CA_7A-46A, CA_41A-46A, CA_42A-46A	Finterferer (CW)	MHz	$-60 < f - F_{DL_Low(j)} < -15$ with $j \le K$ or $15 < f - F_{DL_High(j)} < 60$ with $j \le K$	$-85 < f - F_{DL_Low(j)} \le -60$ or $60 \le f - F_{DL_High(j)} < 85$	$1 \le f \le F_{DL_Low(j)} - 85$ or $F_{DL_High(j)} + 85 \le f$ ≤ 12750

- NOTE 1: F_{DL_Low(j)} and F_{DL_High(j)}, j = 1,...,K,...N, denote the respective lower and upper frequency limits of the (non-overlapping) operating bands of the CA configuration numbered in increasing order of frequency, with N the number of bands in the band combination and K the number of bands with F_{DL_High} ≤ 3600 MHz (K = 1 and N = 2 in the present version of this specification).
- NOTE 2: For $F_{DL_Low(j)} 15$ MHz $\leq f \leq F_{DL_High(j)} + 15$ MHz the appropriate adjacent channel selectivity and in-band blocking requirements in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier j = 1.
- NOTE 3: For $F_{DL_Low(N)} 60$ MHz $\leq f \leq F_{DL_High(N)} + 60$ MHz the appropriate adjacent channel selectivity and in-band blocking requirements in the respective subclauses 7.5.1A and 7.6.1.1A shall be applied for carrier N = 2.
- NOTE 4: $\Delta R_{IB,c}$ according to Table 7.3.1-1A applies when serving cell c is measured.
- NOTE 5: The power level (P_{Interferer}) for Range 3 is modified to -20 dBm for F_{Interferer} > 4400 MHz except for band combinations with Band 42 for which P_{Interferer} for Range 3 is modified to -20 dBm for F_{Interferer} > 2800 MHz...

For Table 7.6.2.1A-0 and Table 7.6.2.1A-0b in frequency ranges 1, 2 and 3, up to $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$ exceptions per downlink are allowed for spurious response frequencies for one active uplink when measured using a step size of 1 MHz.

For Table 7.6.2.1A-0 in frequency ranges 1, 2 and 3, up to $2 \cdot \max(24.6 \cdot \lceil N_{RB} \cdot /6 \rceil)$ exceptions per downlink are allowed for spurious response frequencies for two active uplinks when measured using a step size of 1 MHz. For these exceptions the requirements in clause 7.7.1A apply.

For intra-band contiguous carrier aggreagations the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.6.2.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2.

The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6.2.1A-1 and Tables 7.6.2.1A-2 being on either side of the aggregated signal. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6.2.1A-1 and 7.6.2.1A-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.6.2.1A-1 and 7.6.2.1A-2.

For Table 7.6.2.1A-2 in frequency range 1, 2 and 3, up to $\max(24.6 \cdot \lceil N_{RB} \cdot /6 \rceil)$ exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

Table 7.6.2.1A-1: Out-of-band blocking parameters

Rx Parameter	Units	CA Bandwidth Class					
		В	С	D	E	F	
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSE	NS + CA B	andwidth C below	lass specifi	c value	
		9	9	9	9		
NOTE 1: The transmitter shall be set to 4dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A. NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.							

Table 7.6.2.1A-2: Out of band blocking

CA configuration	Parameter	Units		Frequency	,		
			Range 1	Range 2	Range 3		
	P _{Interferer}	dBm	-44	-30	-15		
CA_1C, CA_2C, CA_3C, CA_5B, CA_7C, CA_8B, CA_12B, CA_23B, CA_27B, CA_38C, CA_40C, CA_41C,	FInterferer	MHz	F _{DL_low} - 15 to F _{DL_low} - 60	F _{DL_low} - 60 to F _{DL_low} - 85	F _{DL_low} - 85 to 1 MHz		
CA_40D, CA_42C ¹ , CA_42D ¹ , CA_42E ¹ , CA_66B, CA_66C	(CW)		F _{DL_high} +15 to F _{DL_high} + 60	F _{DL_high} +60 to F _{DL_high} +85	F _{DL_high} +85 to +12750 MHz		
NOTE 1: The power level of the interferer (P _{Interferer}) for this CA configuration for Range 3 shall be modified to -20							
dBm for Finterferer > 2800 MHz and Finterferer < 4400 N	•						

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the out-of-band blocking requirements are defined with the uplink configuration in accordance with table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.6.2.1 and 7.6.2.1A for one component carrier and two component carriers per sub-block, respectely. The requirements apply with all downlink carriers active

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to $\max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$ exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies for one active uplink

when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to $\max\{8, \lceil (N_{RB}+2\cdot L_{CRBs})/8 \rceil \}$ exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies for one active uplink when measured using a 1MHz step size. For these exceptions the requirements of clause 7.7 spurious response are applicable.

For intra-band non-contiguous carrier aggregation with two uplink carriers and two downlink carriers, the out-of-band blocking requirements are defined with the uplink configuration of the PCC and SCC being in accordance with Table 7.3.1A-4 and powers of both carriers set to $P_{CMAX_L,c} - 7$ dBm. The UE shall meet the requirements specified in subclause 7.6.2.1 for each component carrier while both downlink carriers are active.

For Table 7.6.2.1-2 in frequency range 1, 2 and 3, up to $2 \cdot \max(24,6 \cdot \lceil N_{RB} \cdot /6 \rceil)$ exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies for two active uplinks in the same operating band when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7 spurious response are applicable.

For Table 7.6.2.1-2 in frequency range 4, up to $2 \cdot \max(8, \lceil (N_{RB} + 2 \cdot L_{CRBs})/8 \rceil)$ exceptions per assigned E-UTRA channel per sub-block of the E-UTRA CA configuration are allowed for spurious response frequencies for two active uplinks in the same operating band when measured using a 1MHz step size. For these exceptions the requirements of clause 7.7 spurious response are applicable.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two noncontiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and the uplink assigned to one E-UTRA band, the requirement is defined with the uplink active a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For the two non-contiguous component carriers within the same band, P_{wanted} in Table 7.6.2.1A-0 is set using $\Delta R_{IBNC} = 0$ dB for all sub-block gaps (Table 7.3.1A-3) while a band supporting contiguously aggregated carriers the out-of-band blocking parameters in Table 7.6.2.1-1 are replaced by those specified in Table 7.6.2.1A-1. For each downlink the UE shall meet the out-of-band blocking requirements applicable for inter-band carrier aggregation with one component carrier per operating band but with up to four component carriers assigned to the same band with the following exception. For each component carrier of the E-UTRA CA Configurations CA_1A-46A, CA_2A-46A, CA_3A-46A, CA_4A-46A, CA_7A-46A, CA_41A-46A, CA_42A-46A the requirements specified in Table 7.6.2.1A-0 are replaced by those in 7.6.2.1A-0a. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

7.6.2.1D Minimum requirements for ProSe

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2 with parameters specified in Tables 7.6.2.1D-1, 7.6.2.1D-2 and 7.6.2.1D-3.

For Table 7.6.2.1D-3 in frequency range 1, 2 and 3, up to $\max(24, 6 \cdot \lceil N_{RB} / 6 \rceil)$ exceptions are allowed for

spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size, where N_{RB} is the number of resource blocks in the downlink transmission bandwidth configuration (see Figure 5.6-1). For these exceptions the requirements of subclause 7.7 Spurious response are applicable.

Table 7.6.2.1D-1: Out-of-band blocking parameters for ProSe Direct Discovery

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in Transmission	dBm	Prefsens_Prose + channel bandwidth specific value below + Poffset					
Bandwidth Configuration	UDIII			6	6	7	9
Poffset	dB			10.9	13.9	15.7	16.9
NOTE 2: Reference measurement channel is specified in Annex A.6.2.							

Table 7.6.2.1D-2: Out-of-band blocking parameters for ProSe Direct Communication

Rx Parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Power in		Prefsens_Prose + channel bandwidth specific value below					
Transmission Bandwidth	dBm			6	6	7	9
Configuration							
NOTE 1: Reference measurement channel is specified in Annex A.6.2.							

Table 7.6.2.1D-3: Out of band blocking for ProSe

E-UTRA	Parameter	Units	Frequency					
ProSe			Range 1	Range 2	Range 3			
band	PInterferer	dBm	-44	-30	-15			
			F _{DL_low} -15 to	F _{DL_low} -60 to	F _{DL_low} -85 to			
2,3,4,7,14,	F _{Interferer}	MHz	F _{DL_low} -60	F _{DL_low} -85	1 MHz			
20,26,28,31	(CW)	IVIITZ	F _{DL_high} +15 to	F _{DL_high} +60 to	F _{DL_high} +85 to			
			F _{DL_high} + 60	FDL_high +85	+12750 MHz			
NOTE 1: For	the UE which su	pports both	n Band 11 and Band	21 the out of blockir	ng is FFS.			

7.6.2.1F Minimum requirements for category NB1

The category NB1 UE throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.3.2 with parameters specified in Table 7.6.2.1F-1.

For Table 7.6.2.1F-1 in frequency range 1, 2 and 3, up to 24 exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a 1MHz step size. For these exceptions the requirements of subclause 7.7.1F spurious response are applicable.

Frequency **Parameter** Units Range 3 Range 1 Range 2 REFSENS + 6 dB Pwanted dRm Pinterferer (CW) dBm -44 -30 -15 FDL low - 60 to FDL low - 85 F_{DL} low - 85 to 1 MHz MHz FDL low - 15 to FDL low - 60 Finterferer range MHz $F_{DL_high} + 15$ to $F_{DL_high} + 60$ FDL_high + 60 to FDL_high + 85 F_{DL_high} + 85 to 12750 MHz

Table 7.6.2.1F-1: Out-of-band blocking parameters for category NB1 UE

- NOTE 1: For operating bands which downlink band frequency range is between 729 MHz < 1 GHz the power level of the interferer (P_{Interferer}) for Range 3 shall be modified to: -18 dBm for the frequency range which is bounded by F_{DL_low} 150 MHz of the lowest band that UE supports in frequency range 729 MHz < 1 GHz and F_{DL_high} + 150 MHz of the highest band that UE supports in frequency range 729 MHz < 1 GHz.
- NOTE 2: For operating bands which downlink band frequency range is between 1805 MHz < f < 2200 MHz the power level of the interferer (P_{Interferer}) for Range 3 shall be modified to: -20 dBm for the frequency range which is bounded by F_{DL_low} 200 MHz of the lowest band that UE supports in frequency range 1805 MHz < f < 2200 MHz and F_{DL_high} + 200 MHz of the highest band that UE supports supports in frequency range 1805 MHz < f < 2200 MHz.

7.6.3 Narrow band blocking

This requirement is measure of a receiver's ability to receive a E-UTRA signal at its assigned channel frequency in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

7.6.3.1 Minimum requirements

The relative throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Channel Bandwidth Parameter Unit 1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz PREFSENS + channel-bandwidth specific value below P_{w} dBm 22 16 18 16 13 14 P_{uw} (CW) dBm -55 -55 -55 -55 -55 -55 Fuw (offset for 1.7025 2.7075 5.2125 MHz 0.9075 7.7025 10.2075 $\Delta f = 15 \text{ kHz}$ Fuw (offset for MHz $\Delta f = 7.5 \text{ kHz}$

Table 7.6.3.1-1: Narrow-band blocking

- NOTE 1: The transmitter shall be set a 4 dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax_L as defined in subclause 6.2.5.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The P_{REFSENS} power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.
- NOTE 4: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3.1E-3 should be used as Prefsens for Pw.
- NOTE5: For DL category M1 UE, the parameters for the applicable channel bandwidth apply.

For the UE which supports inter-band CA configuration in Table 7.3.1-1A, P_{UW} power defined in Table 7.6.3.1-1 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.6.3.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the narrow-band blocking requirements are defined with the uplink active on the band(s) other than the

band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.3.1 for each component carrier while all downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the narrow-band blocking requirements of subclause 7.6.3.1A do not apply. For E-UTRA CA configurations with a component carrier assigned in Band 46, narrow-band blocking requirements do not apply in the presence of a narrow-band interferer in Band 46.

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For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.6.3.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.6.3.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.1A-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Table 7.6.3.1A-1.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the narrow band blocking requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.6.3.1 and 7.6.3.1A for one component carrier and two component carriers per sub-block, respectively. The requirements apply for in-gap and out-of-gap interferers while all downlink carriers are active.

CA Bandwidth Class Unit **Parameter** R Ε F D Pw in Transmission Bandwidth REFSENS + CA Bandwidth Class specific value below dBm Configuration, per CC 16⁴ 16 16 dBm Puw (CW) -55 -55 - F_{offset} - Foffset $F_{\text{offset}} - 0.2$ 0.2 0.2 Fuw (offset for MHz / / $\Delta f = 15 \text{ kHz}$ + Foffset + 0.2 + Foffset + 0.2 + Foffset + + Foffset + 0.2 0.2 Fuw (offset for MHz $\Delta f = 7.5 \text{ kHz}$

Table 7.6.3.1A-1: Narrow-band blocking

- NOTE 1: The transmitter shall be set to 4dB below PCMAX_L,c or PCMAX_L as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The F_{uw} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to $[F_{interferer}/0.015+0.5]0.015+0.0075$ MHz to be offset from the sub-carrier raster.
- NOTE 4: The requirement is applied for the band combinations whose component carriers' BW≥5 MHz.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For these uplink configurations, the UE shall meet the narrow-band blocking requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks with $\Delta R_{IBNC} = 0$ dB for all sub-block gaps (Table 7.3.1A-3) for the two non-contiguous downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.6.3. For E-UTRA CA configurations with a component carriers assigned in Band 46, narrow-band blocking

requirements do not apply in the presence of a narrow-band interferer in Band 46. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

7.6.3.1D Minimum requirements for ProSe

The relative throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2 with parameters specified in Table 7.6.3.1D-1 and Table 7.6.3.1D-2.

Table 7.6.3.1D-1: Narrow-band blocking for ProSe Direct Discovery

Parameter	Unit		Channel Bandwidth						
Parameter	Offic	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz		
Pw	dPm	PREFSENS_ProSe + channel-bandwidth specific value below + Poffset							
Fw	dBm			16	13	14	16		
P _{uw} (CW)	dBm			-55	-55	-55	-55		
Poffset	dB			10.9	13.9	15.7	16.9		
F_{uw} (offset for $\Delta f = 15 \text{ kHz}$)	MHz			2.7075	5.2125	7.7025	10.2075		
F _{uw} (offset for $\Delta f = 7.5 \text{ kHz}$)	MHz								
NOTE 1: Referen	nce measurem	ent channel i	s specified ir	n Annex A.6.	2.				

Table 7.6.3.1D-2: Narrow-band blocking for ProSe Direct Communication

Parameter	Unit	Channel Bandwidth						
Farameter	Onit	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
Pw	dDm	P _{REF}	SENS_ProSe + C	hannel-band	width spec	ific value b	elow	
FW	dBm			16	13	14	16	
P _{uw} (CW)	dBm			-55	-55	-55	-55	
F_{uw} (offset for $\Delta f = 15 \text{ kHz}$)	MHz			2.7075	5.2125	7.7025	10.2075	
F_{uw} (offset for $\Delta f = 7.5 \text{ kHz}$)	MHz							
NOTE 1: Referen	NOTE 1: Reference measurement channel is specified in Annex A.6.2.							

For the UE which supports inter-band CA configuration in Table 7.3.1-1A, P_{UW} power defined in Table 7.6.3.1D-1 and Table 7.6.3.1D-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.6A Void

<Reserved for future use>

7.6B Blocking characteristics for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.6 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

7.7 Spurious response

Spurious response is a measure of the receiver's ability to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking limit as specified in subclause 7.6.2 is not met.

7.7.1 Minimum requirements

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Table 7.7.1-1: Spurious response parameters

Rx parameter	Units	Channel bandwidth								
		1.4 MHz	1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz							
Power in		REF	REFSENS + channel bandwidth specific value below							
Transmission Bandwidth Configuration	dBm	6 6 6 6 7 9								

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2.
- N OTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.

Table 7.7.1-2: Spurious response

Parameter	Unit	Level
P _{Interferer} (CW)	dBm	-44
F _{Interferer}	MHz	Spurious response frequencies

For the UE which supports inter-band CA configuration in Table 7.3.1-1A, $P_{interferer}$ power defined in Table 7.7.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.7.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the spurious response requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The throughput measured in each downlink with $F_{interferer}$ in Table 7.6.2.1A-0 and Table 7.6.2.1A-0a at spurious response frequencies shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1-1 and 7.7.1-2. The UE shall meet these requirements for each component carrier while all downlink carriers are active.

For inter-band carrier aggregation with one component carrier per operating band and the uplink active in two E-UTRA bands, the spurious response requirements applicable specified above shall be met with the transmitter power for the uplink set to 7 dB below $P_{CMAX_L,c}$ for each serving cell c.

For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the spurious response requirements of subclause 7.7.1A do not apply.

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active

throughout the test. The uplink output power shall be set as specified in Table 7.7.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggregation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The throughput of each carrier shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.7.1A-1 and 7.7.1A-2. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.7.1A-1 and 7.7.1A-2

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the spurious response requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.7.1 and 7.7.1A for one component carrier and two component carriers per sub-block, respectively. The requirements apply with all downlink carriers active.

For intra-band non-contiguous carrier aggregation with two uplink carriers and two downlink carriers, the spurious response requirements applicable specified above shall be met with the transmitter powers for the uplinks set to $P_{CMAX_L,c} - 7 \text{ dBm}$.

Rx Parameter	Units	CA Bandwidth Class						
		В	С	D	E	F		
Pw in Transmission Bandwidth	dBm	REFSE	NS + CA Bar	ndwidth Class	specific value	e below		
Configuration, per CC	ubili	a	a	a	a			

Table 7.7.1A-1: Spurious response parameters

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L, or Pcmax_L as defined in subclause 6.2.5A.

NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern
OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

Parameter	Unit	Level
P _{Interferer} (CW)	dBm	-44
Finterferer	MHz	Spurious response frequencies

Table 7.7.1A-2: Spurious response

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. The downlink PCC shall be configured closer to the uplink operating band than the downlink SCC(s) when the uplink is active in band(s) supporting contiguous aggregation of up to four component carriers. For the two non-contiguous component carriers within the same band, P_{wanted} in Table 7.6.2.1A-0 is set using $\Delta R_{IBNC} = 0$ dB for all sub-block gaps (Table 7.3.1A-3) while a band supporting contiguously aggregated carriers the out-of-band blocking parameters in Table 7.7.1-1 are replaced by those specified in Table 7.7.1A-1. For each downlink the UE shall meet the spurious-response requirements applicable for inter-band carrier aggregation with one component carrier per operating band but with up to three component carriers assigned to the same band. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

7.7.1B Minimum requirements for UL-MIMO

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.7.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

7.7.1D Minimum requirements for ProSe

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annex A.6.2 with parameters specified in Tables 7.7.1D-1, 7.7.1D-2, and 7.7.1D-3.

Table 7.7.1D-1: Spurious response parameters for ProSe Direct Discovery

Rx parameter	Units	Channel bandwidth								
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz			
Power in		Prefsens	Prefsens_Prose + channel bandwidth specific value below+ Poffset							
Transmission	dBm									
Bandwidth	UBIII			6	6	7	9			
Configuration										
Poffset	dB			10.9	13.9	15.7	16.9			
NOTE 1: Reference measurement channel is specified in Annex A.6.2.										

Table 7.7.1D-2: Spurious response parameters for ProSe Direct Communication

Rx parameter	Units	Channel bandwidth								
		1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 N								
Power in		Prefsens_prose + channel bandwidth specific value below								
Transmission	dBm									
Bandwidth	ubili			6	6	7	9			
Configuration										
NOTE 1: Reference measurement channel is specified in Annex A.6.2.										

Table 7.7.1D-3: Spurious response for ProSe

Parameter	Unit	Level
P _{Interferer} (CW)	dBm	-44
F _{Interferer}	MHz	Spurious response frequencies

For the UE which supports inter-band CA configuration in Table 7.3.1-1A, $P_{interferer}$ power defined in Table 7.7.1D-3 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.7.1F Minimum requirements for UE category NB1

The category NB1 UE throughput shall be \geq 95% of the maximum throughput of the reference measurement channel as specified in Annexe A.3.2 with parameters specified in Tables 7.7.1F-1.

Table 7.7.1F-1: Spurious response parameters for UE category NB1

Parameter	Unit	Level						
P _{signal}	dBm	REFSENS+6						
PInterferer (CW)	dBm	-44						
FInterferer	MHz Spurious response freq							
Number of spurious response frequencies		24 (in OOB range 1, 2, 3)						
NOTE 1: Reference measurement channel is specified in Annex A.3.2.								

NOTE 2: The REFSENS power level is specified in 7.3.1F.1-1.

NOTE 3: OOB range 1, 2, 3 refers to Table 7.6.2.1F-1.

7.8 Intermodulation characteristics

Intermodulation response rejection is a measure of the capability of the receiver to receiver a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

7.8.1 Wide band intermodulation

The wide band intermodulation requirement is defined following the same principles using modulated E-UTRA carrier and CW signal as interferer.

7.8.1.1 Minimum requirements

The throughput shall be $\geq 95\%$ of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1.1 for the specified wanted signal mean power in the presence of two interfering signals. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements only apply for carriers assigned in the paired part.

Channel bandwidth **Rx Parameter** Units 1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz REFSENS + channel bandwidth specific value below Power in Transmission dBm Bandwidth 12 8 6 6 7 9 Configuration dBm PInterferer 1 -46 (CW) PInterferer 2 dBm -46 (Modulated) BW_{Interferer 2} 1.4 MHz -BW/2 -2.1 -BW/2 - 7.5Finterferer 1 -BW/2 -4.5 (Offset) +BW/2+ 2.1 +BW/2 + 4.5 +BW/2 + 7.5MHz FInterferer 2 2*FInterferer 1 (Offset)

Table 7.8.1.1-1: Wide band intermodulation

- NOTE 1: The transmitter shall be set to 4dB below Pcmax L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax L as defined in subclause 6.2.5.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1The interfering modulated signal is 5MHz E-UTRA signal as described in Annex D for channel bandwidth ≥5MHz.
- NOTE 4: The REFSENS power level is specified in Table 7.3.1-1 and Table 7.3.1-1a for two and four antenna ports, respectively.
- NOTE 5: For DL category M1 UE, the reference sensitivity for category M1 in table 7.3.1E-3 should be used as REFSENS for the power in Transmission Bandwidth Configuration.
- NOTE6: For DL category M1 UE, the parameters for the applicable channel bandwidth apply, and BW refers to the corresponding channel bandwidth.

For the UE which supports inter band CA configuration in Table 7.3.1-1A, $P_{interferer1}$ and $P_{interferer2}$ powers defined in Table 7.8.1.1-1 are increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.8.1A Minimum requirements for CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one E-UTRA band the wide band intermodulation requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.8.1.1 for each component carrier while all downlink carriers are active. For E-UTRA CA configurations including an operating band without uplink band or an operating band with an unpaired DL part (as noted in Table 5.5-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. For a component carrier configured in Band 46, the requirements specified in subclause 7.8.1.1 are replaced by the requirements in Table 7.8.1-1A-0.

Table 7.8.1.1A-0: Wide band intermodulation

E-UTRA band	Rx Parameter	Units	Channel bandwidth						
			1.4 MHz	3 M	lHz	5 MHz	10 MHz	15 MHz	20 MHz
	Power in		REF	SENS -	+ chanı	nel bandwi	dth specific	value belo	W
	Transmission Bandwidth Configuration	dBm							9
	P _{Interferer 1} (CW)	dBm	-46						
46	P _{Interferer 2} (Modulated)								
40	BW _{Interferer 2}								20
	FInterferer 1 (Offset) MHz								-BW/2 - 30 / +BW/2 + 30
	F _{Interferer 2} (Offset)	MHz	2*FInterferer 1						

NOTE 1: The transmitter shall be set to 4dB below Pcmax_L at the minimum uplink configuration specified in Table 7.3.1-2 with Pcmax L as defined in subclause 6.2.5.

NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in Annex A.5.1.1/A.5.2.1/A.5.4.1.

NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

For E-UTRA CA configurations listed in Table 7.3.1A-0a under conditions for which reference sensitivity for the operating band being tested is N/A, the wideband intermodulation requirements of subclause 7.8.1A do not apply.

For intra-band contiguous carrier aggegation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC, For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.8.1A-1 with the uplink configuration set according to Table 7.3.1A-1 for the applicable carrier aggreagation configuration. For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.1-2. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.8.1A-1 being on either side of the aggregated signal. The throughput of each carrier shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.1A-1. For operating bands with an unpaired DL part (as noted in Table 5.5-1), the requirements also apply for an SCC assigned in the unpaired part with parameters specified in Tables 7.8.1A-1.

Table 7.8.1A-1: Wide band intermodulation

Rx parameter	Units		ass							
-		В	С	D	E	F				
P _w in		RE	REFSENS + CA Bandwidth Class specific value below							
Transmission Bandwidth Configuration, per CC	dBm	9	12	13.8	15					
PInterferer 1 (CW)	dBm		-46							
P _{Interferer 2} (Modulated)	dBm			-46						
BW _{Interferer 2}	MHz	5	5	5	5					
F _{Interferer 1} (Offset)	MHz	-F _{offset} -7.5 / + F _{offset} +7.5	-F _{offset} -7.5 / + F _{offset} +7.5	-F _{offset} -7.5 / + F _{offset} +7.5	-F _{offset} -7.5 / + F _{offset} +7.5					
F _{Interferer 2} (Offset)	MHz	2*FInterferer 1								

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 with set-up according to Annex C.3.1.
- NOTE 4: The interfering modulated signal is 5MHz E-UTRA signal as described in Annex D for channel bandwidth ≥5MHz:
- NOTE 5: The F_{interferer 1} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the CW interferer and F_{interferer 2} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the modulated interferer.

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink sub-blocks, the wide band intermodulation requirements are defined with the uplink configuration in accordance with Table 7.3.1A-3. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.8.1.1 and in this subclause for one component carrier and two component carriers per sub-block, respectively. The requirements apply for out-of-gap interferers while all downlink carriers are active.

For combinations of intra-band and inter-band carrier aggregation with up to five downlink carriers (up to two non-contiguously sub-blocks per band and up to four contiguously aggregated carriers per band) and one uplink carrier assigned to one E-UTRA band, the requirement is defined with the uplink active in a band other than that supporting the downlink(s) under test. The uplink configuration shall be in accordance with Table 7.3.1A-3 when the uplink is active in the band supporting two non-contiguous component carriers, Table 7.3.1A-1 when the uplink is active in a band supporting two contiguous component carriers and in accordance with Table 7.3.1-2 when the uplink is active in a band supporting one carrier per band. For these uplink configurations, the UE shall meet the wide-band intermodulation requirements for intra-band non-contiguous carrier aggregation of two downlink sub-blocks with $\Delta R_{IBNC} = 0$ dB for all sub-block gaps (Table 7.3.1A-3) for the two non-contiguous downlink sub-blocks, the requirements for intra-band contiguous carrier aggregation for the contiguously aggregated downlink carriers and for any remaining component carrier(s) the requirements specified in subclause 7.8.1. For contiguously aggregated component carriers configured in Band 46, the said requirements for intra-band contiguous carrier aggregation of two downlink carriers are replaced by requirements in Table 7.8.1A-2. All downlink carriers shall be active throughout the tests and the requirements for the downlinks shall be met with the single uplink carrier active in each band capable of UL operation.

Table 7.8.1A-2: Wide band intermodulation

E-UTRA Band	Rx parameter	Units		CA	Bandwidth C	lass			
	-		В	С	D	E	F		
	Power per CC in		REFSENS + CA Bandwidth Class specific value b						
	Aggregated Transmission Bandwidth Configuration	dBm		12	13.8	15			
	P _{Interferer 1} (CW)	dBm			-46				
46	P _{Interferer 2} (Modulated)	dBm			-46				
	BW _{Interferer 2}	MHz		20	20	20			
	Finterferer 1 (Offset)	MHz		-F _{offset} -30 / + F _{offset} +30	-F _{offset} -30 / + F _{offset} +30	-F _{offset} -30 / + F _{offset} +30			
	F _{Interferer 2} (Offset)	MHz			2*FInterferer 1	•			

- NOTE 1: The transmitter shall be set to 4dB below Pcmax_L,c or Pcmax_L as defined in subclause 6.2.5A.
- NOTE 2: Reference measurement channel is specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
- NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annex A.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD/FS3 as described in Annex A.5.1.1/A.5.2.1/A.5.4.1 with set-up according to Annex C.3.1.
- NOTE 4: The interfering modulated signal is 20 MHz E-UTRA signal as described in Annex D interference setting 2;
- NOTE 5: The Finterferer 1 (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the CW interferer and Finterferer 2 (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the modulated interferer.

7.8.1B Minimum requirements for UL-MIMO

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.8.1 shall be met with the UL-MIMO configurations specified in Table 6.2.2B-2. For UL-MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

7.8.1D Minimum requirements for ProSe

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channels as specified in Annex A.6.2 with parameters specified in Table 7.8.1D-1, Table 7.8.1D-2, and Table 7.8.1D-3 for the specified wanted signal mean power in the presence of two interfering signals

Table 7.8.1D-1: Wide band intermodulation parameters for ProSe Direct Discovery

Rx parameter	Units	Channel bandwidth							
		1.4 MHz 3 MHz 5 MHz 10 MHz 15 MHz 20 MHz							
Poffset	dB	10.9 13.9 15.7 16.9							

Table 7.8.1D-2: Wide band intermodulation for ProSe Direct Communication

Rx parameter	Units	Channel bandwidth					
		1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
Poffset	dB			0	0	0	0

Rx Parameter Units Channel bandwidth 15 MHz 1.4 MHz 3 MHz 5 MHz 10 MHz 20 MHz PREFSENS_ProSe + channel bandwidth specific value below+ Poffset Power in Transmission dBm 7 9 Bandwidth 12 6 6 8 Configuration dBm P_{Interferer 1} -46 (CW) PInterferer 2 dBm -46 (Modulated) BW_{Interferer 2} 1.4 Finterferer 1 MHz -BW/2 -2.1 -BW/2 -4.5 -BW/2 - 7.5 (Offset) +BW/2+ 2.1 +BW/2 + 4.5 +BW/2 + 7.5MHz F_{Interferer 2} 2*FInterferer 1 (Offset)

Table 7.8.1D-3: Wide band intermodulation for ProSe

NOTE 1: Reference measurement channel is specified in Annex A.6.2

NOTE 2: The interferer is QPSK modulated PUSCH containing data and reference symbols. Normal cyclic prefix is used. The data content shall be uncorrelated to the wanted signal and modulated according to clause 5 of TS36.211

For the UE which supports inter band CA configuration in Table 7.3.1-1A, $P_{interferer1}$ and $P_{interferer2}$ powers defined in Table 7.8.1D-3 are increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.1-1A.

7.8.1F Minimum requirements for category NB1

The throughput shall be \geq 95% of the maximum throughput of the reference measurement channel as specified in Annex A.3.2 with parameters specified in Table 7.8.1F-1 for the specified wanted signal mean power in the presence of two interfering signals.

Table 7.8.1F-1: Wide band intermodulation for category NB1

Parameters for wideband intermodulation					
Category NB1 signal power	REFSENS + 12 dB				
CW interferer signal power	- 46 dBm				
1.4 MHz E-UTRA interferer signal power	- 46 dBm				
CW interferer offset	± 2.2 MHz				
1.4 MHz E-UTRA interferer offset	± 4.4 MHz				

7.8.2 Void

7.9 Spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

7.9.1 Minimum requirements

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.1-1

Table 7.9.1-1: General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level	NOTE
30MHz ≤ f < 1GHz	100 kHz	-57 dBm	
1GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	
12.75 GHz ≤ f ≤ 5 th harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 dBm	1

NOTE 1: Applies only for Band 22, Band 42 and Band 43

NOTE 2: Unused PDCCH resources are padded with resource element groups with power level given

by PDCCH_RA/RB as defined in Annex C.3.1.

7.9.1A Minimum requirements

For E-UTRA CA configurations including an operating band without uplink band (as noted in Table 5.5-1), the power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.1A-1.

Table 7.9.1A-1: General receiver spurious emission requirements

Frequency band	Measurement bandwidth	Maximum level	NOTE
30MHz ≤ f < 1GHz	100 kHz	-57 dBm	
1GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	
12.75 GHz ≤ f ≤ 26 GHz	1 MHz	-47 dBm	3

NOTE 1: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH_RA/RB as defined in Annex C.3.1.

NOTE 2: The requirements apply when the UE is configured for carrier aggregation but is not transmitting.

NOTE 3: Applies only for Band 46

7.10 Receiver image

7.10.1 Void

7.10.1A Minimum requirements for CA

Receiver image rejection is a measure of a receiver's ability to receive the E-UTRA signal on one component carrier while it is also configured to receive an adjacent aggregated carrier. Receiver image rejection ratio is the ratio of the wanted received power on a sub-carrier being measured to the unwanted image power received on the same sub-carrier when both sub-carriers are received with equal power at the UE antenna connector.

For intra-band contiguous carrier aggregation the UE shall fulfil the minimum requirement specified in Table 7.10.1A-1 for all values of aggregated input signal up to -22 dBm.

Table 7.10.1A-1: Receiver image rejection

	CA bandwidth class						
Rx parameter	Units	Α	В	С	D	Е	F
Receiver image rejection	dB		25	25	25	25	

8 Performance requirement

This clause contains performance requirements for the physical channels specified in TS 36.211 [4]. The performance requirements for the UE in this clause are specified for the measurement channels specified in Annex A.3, the propagation conditions in Annex B and the downlink channels in Annex C.3.2.

NOTE: For the requirements in the following sections, similar Release 8 and 9 requirements apply for time domain measurements restriction under colliding CRS.

8.1 General

8.1.1 Receiver antenna capability

The performance requirements are based on UE(s) that utilize one or more antenna receivers.

For all test cases, the SNR is defined as

$$SNR = \frac{\sum_{j=1}^{N_{RX}} \hat{E}_{s}^{(j)}}{\sum_{j=1}^{N_{RX}} N_{oc}^{(j)}}$$

where N_{RX} denotes the number of receiver antenna connectors and the superscript receiver antenna connector j. The above SNR definition assumes that the REs are not precoded. The SNR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SNR requirement applies for the UE categories and CA capabilities given for each test.

For enhanced performance requirements type A, the SINR is defined as

$$SINR = \frac{\sum_{j=1}^{N_{RX}} \hat{E}_{s}^{(j)}}{\sum_{j=1}^{N_{RX}} N_{oc}^{(j)}}$$

where N_{RX} denotes the number of reciver antenna connectors and the superscript receiver antenna connector j. The above SINR definition assumes that the REs are not precoded. The SINR definition does not account for any gain which can be associated to the precoding operation. The relative power of physical channels transmitted is defined in Table C.3.2-1. The SINR requirement applies for the UE categories given for each test.

For the performance requirements specified in this clause, it is assumed that N_{RX} =2 unless otherwise stated.

Table 8.1.1-1: Void

8.1.1.1 Simultaneous unicast and MBMS operations

8.1.1.2 Dual-antenna receiver capability in idle mode

8.1.2 Applicability of requirements

8.1.2.1 Applicability of requirements for different channel bandwidths

In Clause 8 the test cases may be defined with different channel bandwidth to verify the same target FRC conditions with the same propagation conditions, correlation matrix and antenna configuration.

Test cases defined for 5MHz channel bandwidth that reference this clause are applicable to UEs that support only Band 31.

8.1.2.2 Definition of CA capability

The definition with respect to CA capabilities for 2CCs is given as in Table 8.1.2.2-1. The definition with respect to CA capabilities for 3CCs is given in Table 8.1.2.2-3.

Table 8.1.2.2-1: Definition of CA capability with 2DL CCs

CA Capability Description Capability	
CA2_C	Intra-band contiguous CA
CA2_A2	Inter-band CA (two bands)
CA2_N2	Intra-band non-contiguous CA (with two sub-blocks)
cor CA cor CA	2_C corresponds to E-UTRA CA configurations and bandwidth nbination sets defined in Table 5.6A.1-1 for 2 DL CCs. 2_A2 corresponds to E-UTRA CA configurations and bandwidth nbination sets defined in Table 5.6A.1-2 for 2 DL CCs. 2_N2 corresponds to E-UTRA CA configurations and bandwidth nbination sets defined in Table 5.6A.1-3 for 2 DL CCs.

The supported testable aggregated CA bandwidth combinations for 2CCs for each CA capability are listed in Table 8.1.2.2-2.

Table 8.1.2.2-2: Supported testable aggregated CA bandwidth combinations for different CA capability with 2DL CCs

CA Capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD CA	Bandwidth combination for TDD-FDD CA	Bandwidth combination for CA with LAA SCell(s)
CA2 C				` '
CA2_C	5+5MHz,	20+20MHz,	NA	NA
	5+10MHz,	15+20MHz		
	5+15MHz,			
	10+10MHz,			
	20+20MHz			
CA2_A2	10+10MHz,	20+20MHz	10(FDD)+20(TDD)MHz,	20(FDD)+20(LAA)MHz
	20+5MHz,		15(FDD)+20(TDD)MHz,	20(TDD)+20(LAA)MHz
	10+15MHz,		20(FDD)+20(TDD)MHz	
	10+20MHz,			
	15+20MHz,			
	20+20MHz			
CA2_N2	5+10MHz,	20+20MHz	NA	NA
	10+10MHz,			
	10+20MHz,			
	20+20MHz			

NOTE 1: This table is only for information and applicability and test rules of CA performance requirements are specified in 8.1.2.3 and 9.1.1.2.

Table 8.1.2.2-3: Definition of CA capability with 3 DL CCs

CA	CA Capability Description		
Capability			
CA3_C Intra-band contiguous CA			
CA3_A2	Inter-band CA (two bands)		
CA3_A3	Inter-band CA (three bands)		
CA3_N2	Intra-band non-contiguous CA (with two sub-blocks)		
NOTE 1: CA3_C corresponds to E-UTRA CA configurations and bandwidth			
con	nbination sets defined in Table 5.6A.1-1 for 3 DL CCs.		
CA	CA3_A2 corresponds to E-UTRA CA configurations and bandwidth		
con	nbination sets defined in Table 5.6A.1-2 for 3 DL CCs.		
CA3_A3 corresponds to E-UTRA CA configurations and bandwidth			
combination sets defined in and Table 5.6A.1-2a for 3 DL CCs.			
CA3_N2 corresponds to E-UTRA CA configurations and bandwidth			
con	nbination sets defined in Table 5.6A.1-3 for 3 DL CCs.		

The supported testable largest aggregated CA bandwidth combinations for 3CCs for each CA capability are listed in Table 8.1.2.2-4.

Table 8.1.2.2-4: Supported largest aggregated CA bandwidth combinations for different CA capability with 3 CCs

CA capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD CA	Bandwidth combination for TDD-FDD CA
CA3_C	NA	20+20+20MHz	NA
CA3_A2	5+10+10MHz 5+10+20MHz, 5+15+20MHz, 10+10+20MHz, 10+20+20MHz, 20+20+20MHz	15+20+20MHz, 20+20+20MHz	10(FDD)+20(TDD)+20(TDD)MHz 15(FDD)+20(TDD)+20(TDD)MHz, 20(FDD)+20(TDD)+20(TDD)MHz
CA3_A3	10+10+20MHz, 10+15+15MHz, 10+15+20MHz, 10+20+20MHz, 15+15+20MHz, 15+20+20MHz, 20+20+20MHz		2×20(FDD)+20(TDD)MHz, 20(FDD)+ 2×20(TDD)MHz, 20(FDD)+15(FDD)+20(TDD)MHz, 20(FDD)+10(FDD)+20(TDD)MHz, 2×15(FDD)+20(TDD)MHz
CA3_N2	NA	20+20+20MHz	NA

NOTE 1: This table is only for information and applicability and test rules of CA performance requirements are specified in 8.1.2.3 and 9.1.1.2.

Table 8.1.2.2-5: Definition of CA capability with 4 DL CCs

CA	CA Capability Description		
Capability			
CA4_C Intra-band contiguous CA			
CA4_A2	Inter-band CA (two bands)		
CA4_A3	Inter-band CA (three bands)		
CA4_A4	Inter-band CA (four bands)		
CA4_N2	Intra-band non-contiguous CA (with two sub-blocks)		
	4_C corresponds to E-UTRA CA configurations and bandwidth		
cor	nbination sets defined in Table 5.6A.1-1 for 3 DL CCs.		
CA	4_A2 corresponds to E-UTRA CA configurations and bandwidth		
	combination sets defined in Table 5.6A.1-2 for 3 DL CCs.		
CA4_A3 corresponds to E-UTRA CA configurations and bandwidth			
combination sets defined in and Table 5.6A.1-2a for 3 DL CCs.			
CA4_A4 corresponds to E-UTRA CA configurations and bandwidth			
combination sets defined in and Table 5.6A.1-2b for 4 DL CCs			
	4_N2 corresponds to E-UTRA CA configurations and bandwidth		
cor	nbination sets defined in Table 5.6A.1-3 for 3 DL CCs.		

The supported testable largest aggregated CA bandwidth combinations for 4CCs for each CA capability are listed in Table 8.1.2.2-6.

Table 8.1.2.2-6: Supported largest aggregated CA bandwidth combinations for different CA capability with 4 CCs

CA capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD CA	Bandwidth combination for TDD-FDD CA
CA4_C	NA	20+20+20+20MHz	NA
CA4_A2	20+20+20+20MHz	20+20+20+20MHz	20(FDD)+20(TDD)+20(TDD)+20(TDD)MHz
	20+20+10+5MHz	15+20+20+20MHz	
CA4_A3	20+20+20+20MHz	NA	2×20(FDD)+2×20(TDD)MHz,
	20+20+20+10MHz		20(FDD)+15(FDD)+2×20(TDD)MHz,
	20+20+10+10MHz		2×15(FDD)+2x20(TDD)MHz
	20+10+10+5MHz		
CA4_A4	20+20+20+20MHz	NA	2×20(FDD)+15(FDD)+20(TDD)MHz,
	20+20+20+10MHz		2×15(FDD)+20(FDD)+20(TDD)MHz
	20+20+10+10MHz		2×20(FDD)+10(FDD)+20(TDD)MHz
CA4_N2	NA	20+20+20+20MHz	NA

NOTE 1: This table is only for information and applicability and test rules of CA performance requirements are specified in 8.1.2.3 and 9.1.1.2.

Table 8.1.2.2-7: Definition of CA capability with 5 DL CCs

CA	CA Capability Description		
Capability			
CA5_C	Intra-band contiguous CA		
CA5_A2	Inter-band CA (two bands)		
CA5_A3	Inter-band CA (three bands)		
CA5_A4	Inter-band CA (four bands)		
CA5_A5	Inter-band CA (five bands)		
CA5_N2	Intra-band non-contiguous CA (with two sub-blocks)		
NOTE 1: CA	5_C corresponds to E-UTRA CA configurations and bandwidth		
cor	nbination sets defined in Table 5.6A.1-1 for 5 DL CCs.		
	5_A2 corresponds to E-UTRA CA configurations and bandwidth		
	nbination sets defined in Table 5.6A.1-2 for 5 DL CCs.		
	5_A3 corresponds to E-UTRA CA configurations and bandwidth		
	nbination sets defined in and Table 5.6A.1-2a for 5 DL CCs.		
	5_A4 corresponds to E-UTRA CA configurations and bandwidth		
	combination sets defined in and Table 5.6A.1-2b for 5 DL CCs		
CA5_A5 corresponds to E-UTRA CA configurations and bandwidth			
combination sets defined in and Table 5.6A.1-xx for 5 DL CCs			
	CA5_N2 corresponds to E-UTRA CA configurations and bandwidth		
com	bination sets defined in Table 5.6A.1-3 for 5 DL CCs.		

The supported testable largest aggregated CA bandwidth combinations for 5CCs for each CA capability are listed in Table 8.1.2.2-8.

Table 8.1.2.2-8: Supported largest aggregated CA bandwidth combinations for different CA capability with 5 CCs

CA capability	Bandwidth combination for FDD CA	Bandwidth combination for TDD CA	Bandwidth combination for TDD-FDD CA
CA5_C	NA	NA	NA
CA5_A2	NA	NA	NA
CA5_A3	5×20MHz	NA	NA
CA5_A4	5×20MHz	NA	15+2×20(FDD)+2×20(TDD)MHz 2×15+20(FDD)+2×20(TDD)MHz
CA5_A5	NA	NA	
CA5_N2	NA	NA	NA

NOTE 1: This table is only for information and applicability and test rules of CA performance requirements are specified in 8.1.2.3 and 9.1.1.2.

For test cases with more than one component carrier, "Fraction of Maximum Throughput" in the performance requirement refers to the ratio of the sum of throughput values of all component carriers to the sum of the nominal maximum throughput values of all component carriers, unless otherwise stated.

8.1.2.2A Definition of dual connectivity capability

The definition with respect to dual connectivity capabilities for configurations with 2CCs is given as in Table 8.1.2.2A-1. The definition with respect to dual connectivity capabilities for configurations with 3CCs is given as in Table 8.1.2.2A-3. The definition with respect to dual connectivity capabilities for configurations with 4CCs is given as in Table 8.1.2.2A-5.

Table 8.1.2.2A-1: Definition of dual connectivity capability with 2DL CCs

Dual Dual connectivity capability Description connectivity Capability	
DC_A_2 Inter-band dual connecitivty (two bands)	
NOTE 1: DC	A_2 corresponds to E-UTRA dual connectivity configurations and
ban	dwidth combination sets defined for inter-band dual connecitivty (two
bands) as specified in 5.6C .	

The supported testable dual connectivity bandwidth combinations for 2CCs for each dual connectivity capability are listed in Table 8.1.2.2A-2.

Table 8.1.2.2A-2: Supported testable dual connectivity bandwidth combinations for different dual connectivitys capability with 2DL CCs

Dual connectivity capability	Bandwidth combination for FDD dual connectivity	Bandwidth combination for TDD dual connectivity	Bandwidth combination for TDD-FDD dual connectivity
DC_A_2	10+10MHz, 10+20MHz, 10+15MHz, 15+15MHz,15+20MHz, 20+20MHz,15+5MHz	20+20MHz	20(FDD)+20(TDD)MHz
NOTE 1: This table is only	for information and applicability	and test rules of dual connective	rity performance

NOTE 1: This table is only for information and applicability and test rules of dual connectivity performance requirements are specified in 8.1.2.3A

Table 8.1.2.2A-3: Definition of dual connectivity capability with 3DL CCs

Dual connectivity Capability	Dual connectivity capability Description
DC_A_3	Inter-band dual connecitivty (three bands)
ban	_A_3 corresponds to E-UTRA dual connectivity configurations and dwidth combination sets defined for inter-band dual connecitivty (three ds) as specified in 5.6C.

The supported testable dual connectivity bandwidth combinations for 3CCs for each dual connectivity capability are listed in Table 8.1.2.2A-4.

Table 8.1.2.2A-4: Supported testable dual connectivity bandwidth combinations for different dual connectivitys capability with 3DL CCs

Dual connectivity capability	Bandwidth combination Bandwidth combin for FDD dual connectivity for TDD dual connectivity	
DC_A_3	20+20+15MHz,	3x20MHz
	20+15+15MHz,	
	20+10+10MHz,	
	15+15+10MHz,	
	20+10+15MHz,	
	20+20+20MHz,	
	20+20+10MHz,	
	3x20 MHz	
NOTE 1: This table is only	for information and applicability	and test rules of dual
connectivity perfo	rmance requirements are specif	ied in 8.1.2.3A

Table 8.1.2.2A-5: Definition of dual connectivity capability with 4DL CCs

Dual connectivity Capability	Dual connectivity capability Description
DC_A_4	Inter-band dual connecitivty (four bands)
NOTE 1: DC	_A_4 corresponds to E-UTRA dual connectivity configurations and
ban	dwidth combination sets defined for inter-band dual connecitivty (four
ban	ds) as specified in 5.6C.

The supported testable dual connectivity bandwidth combinations for 3CCs for each dual connectivity capability are listed in Table 8.1.2.2A-6.

Table 8.1.2.2A-6: Supported testable dual connectivity bandwidth combinations for different dual connectivitys capability with 4DL CCs

Dual connectivity capability	Bandwidth combination for FDD dual connectivity	Bandwidth combination for TDD dual connectivity
DC_A_4	N/A	4x20MHz, 3x20+15MHz
NOTE 1: This table is only for information and applicability and test rules of dual connectivity performance requirements are specified in 8.1.2.3A		

8.1.2.3 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Clause 8 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 8.1.2.3-1 and 3 or more DL CCs in Table 8.2.2.3-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 8.1.2.3-1: Applicability and test rules for CA UE demodulation tests with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 2CCs in Clause 8.2.1.1.1, 8.2.1.4.3	Any one of the supported CA capabilities	Any one of the supported FDD CA configurations	10+10 MHz, 20+20 MHz, 5+5 MHz, 10MHz+5MHz, 15MHz+5MHz
CA tests with 2CCs in Clause 8.2.1.3.1	Each supported CA capability	Any one of the supported FDD CA configurations in each CA capability	10+10 MHz, 20+20 MHz, 5+5 MHz, 10MHz+5MHz, other combinations
CA tests with 2CCs in Clause 8.2.1.3.1A, 8.7.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.1.7.1	CA_C	Supported FDD intra-band contiguous CA configurations covering the lowest and highest operating bands	Largest aggregated CA bandwidth combinations
CA tests with 2CCs in Clause 8.2.2.1.1, 8.2.2.4.3	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.2.3.1	Each supported CA capability	Any one of the supported TDD CA configurations in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.2.3.1A, 8.7.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in 8.2.2.7.1	CA_C	Supported TDD intra-band contiguous CA configurations covering the lowest and highest operating bands	Largest aggregated CA bandwidth combinations
CA tests with 2CCs in Clause 8.2.1.8.1	CA_N	CA_3A-3A defined in Table 5.6A.1-3	10+10 MHz
CA tests with 2CCs in Clause 8.2.2.8.1	CA2_C	CA_41C defined in Table 5.6A.1-1	20+20 MHz

NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated.

NOTE 3: A single Uplink CC is configured for all tests

NOTE 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is 1.

Table 8.1.2.3-2: Applicability and test rules for CA UE demodulation tests with 3 or more DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 3 or more CCs in Clause 8.2.1.1.1, 8.2.1.4.3, 8.7.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3 or more CCs in Clause 8.2.1.3.1	Each supported CA capability	Any one of the supported FDD CA configurations in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3 or more CCs in Clause 8.2.2.1.1, 8.2.2.4.3, 8.7.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3 or more CCs in Clause 8.2.2.3.1	Each supported CA capability	Any one of the supported TDD CA configurations in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3CCs in Clause 8.2.2.8.1	CA3_C	CA_41D defined in Table 5.6A.1-1	20+20+20 MHz

NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated.

NOTE 2: Number of the supported bandwidth combinations to be tested from each selected

CA configuration is 1.

NOTE 3: A single Uplink CC is configured for all tests

8.1.2.3A Applicability and test rules for different dual connectivity configuration and bandwidth combination set

The performance requirement for dual connectivity UE demodulation tests in Clause 8 are defined independent of dual connectivity configurations and bandwidth combination sets specified in Clause 5.6C.1. For UEs supporting different dual connectivity configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for the configurations with 2CCs in Table 8.1.2.3A-1 and 3 DL CCs in Table 8.1.2.3A-2. For simplicity, dual connectivity configuration below refers to combination of dual connectivity configuration and bandwidth set.

Both CA performance requirements and dual connectivity performance requirements are applied for dual connectivity capable UE.

Table 8.1.2.3A-1: Applicability and test rules for dual connectivity UE demodulation tests with 2DL CCs

Tests	Dual connectivity capability where the tests apply	Dual connectivity configuration from the selected CA capbility where the tests apply	Dual connectivity Bandwidth combination to be tested in priority order
Dual connectivity test with 2CCs in Clause 8.2.1.4.3A, 8.7.6	Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination	Any one of the supported FDD dual connectvity configurations with the largest aggregated dual connectivity bandwidth combimation	Largest dual connectivity aggregated bandwidth combination
Dual connectivity test with 2CCs in Clause 8.2.2.4.3A, 8.7.7	Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination	Any one of the supported TDD dual connectvity configurations with the largest aggregated dual connectivity bandwidth combination	Largest dual connectivity aggregated bandwidth combination
Dual connectivity test with TDD FDD 2CCs in Clause 8.2.3.4, 8.7.8	Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination	Any one of the supported TDD FDD dual connectvity configurations with the largest aggregated dual connectivity bandwidth combination	Largest dual connectivity aggregated bandwidth combination
NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated. NOTE 2: Number of the supported bandwidth combinations to be tested from each selected DC or CA configuration is 1.			

Table 8.1.2.3A-2: Applicability and test rules for dual connectivity UE demodulation tests with 3DL CCs

Tests	Dual connectivity capability where the tests apply	Dual connectivity configuration from the selected CA capbility where the tests apply	Dual connectivity Bandwidth combination to be tested in priority order
Dual connectivity test with 3CCs in Clause 8.2.1.4.3A, 8.7.6 Any one of the supported dual connectivity capabilities with largest aggregated dual connectivity bandwidth combination		Any one of the supported FDD dual connectvity configurations with the largest aggregated dual connectivity bandwidth combimation	Largest dual connectivity aggregated bandwidth combination
NOTE 1: The applicability and NOTE 2: Number of the support			C or CA configuration is 1.

8.1.2.3B Applicability and test rules for different TDD-FDD CA configurations and bandwidth combination sets

The performance requirement for TDD-FDD CA UE demodulation tests in Clause 8 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL TDD-FDD CA in Table 8.1.2.3B-1 and in Table 8.1.2.3B-2 for 3 or more DL TDD-FDD CA. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 8.1.2.3B-1: Applicability and test rules for CA UE demodulation tests for TDD-FDD CA with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 2CCs in Clause 8.2.3.1.1, 8.2.3.2.1A, 8.2.3.3.1, 8.7.5.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD-FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.3.2.1	Each supported CA capability	Any one of the supported TDD-FDD CA configurations with FDD PCell in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.3.1.2, 8.2.3.2.2A, 8.2.3.3.2, 8.7.5.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD-FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 8.2.3.2.2	Each supported CA capability	Any one of the supported TDD-FDD CA configurations with TDD PCell in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination

NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated.

NOTE 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is

1.

NOTE 3: A single Uplink CC is configured for all tests.

Table 8.1.2.3B-2: Applicability and test rules for CA UE demodulation tests for TDD-FDD CA with 3 or more DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 3CCs in Clause 8.2.3.1.1, 8.2.3.2.1A, 8.2.3.3.1, 8.7.5.1	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD-FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3CCs in Clause 8.2.3.2.1	Each supported CA capability	Any one of the supported TDD-FDD CA configurations with FDD PCell in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3CCs in Clause 8.2.3.1.2, 8.2.3.2.2A, 8.2.3.3.2, 8.7.5.2	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD-FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 3CCs in Clause 8.2.3.2.2	Each supported CA capability	Any one of the supported TDD-FDD CA configurations with TDD PCell in each CA capability with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination

NOTE 1: The applicability and test rules are specified in this table, unless otherwise stated.

NOTE 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is

1.

NOTE 3: A single Uplink CC is configured for all tests.

8.1.2.4 Test coverage for different number of component carriers

For FDD tests specified in 8.2.1.1.1, 8.2.1.3.1, 8.2.1.4.3, and 8.7.1, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

For TDD tests specified in 8.2.2.1.1, 8.2.2.3.1, 8.2.2.4.3, and 8.7.2, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

For TDD FDD tests specified in 8.2.3.1, 8.2.3.2, 8.2.3.3, and 8.7.5, if corresponding TDD FDD CA tests are tested, the test coverage can be considered fulfilled without executing both FDD and TDD single carrier tests.

For FDD CA tests specified in 8.2.1.1.1, 8.2.1.4.3, and 8.7.1, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For FDD CA tests specified in 8.2.1.3.1, for each supported CA capability, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD CA tests specified in 8.2.2.1.1, 8.2.2.4.3, and 8.7.2, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD CA tests specified in 8.2.2.3.1, for each supported CA capability, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD FDD CA tests specified in 8.2.3.1, 8.2.3.3, and 8.7.5, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the TDD FDD CA tests with less than the largest number of CCs supported by the UE.

For TDD FDD CA tests specified in 8.2.3.2, for each supported CA capability, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the TDD FDD CA tests with less than the largest number of CCs supported by the UE.

For FDD CA power imbalance tests specified in 8.2.1.7.1, if they are are tested with FDD intra-band contiguous CA configurations with 2 DL CCs, the test coverage can be considered fulfilled with FDD intra-band contiguous CA configurations with 3 or more DL CCs supported by the UE.

For TDD CA power imbalance tests specified in 8.2.2.7.1, if they are are tested with TDD intra-band contiguous CA configurations with 2 DL CCs, the test coverage can be considered fulfilled with TDD intra-band contiguous CA configurations with 3 or more DL CCs supported by the UE.

For FDD DC tests specified in 8.2.1.4.3 and 8.7.6, among all supported DC capabilities, if corresponding DC tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the DC tests with less than the largest number of CCs supported by the UE.

For TDD FDD DC tests specified in 8.2.3.4 and 8.7.8, among all supported DC capabilities, if corresponding DC tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the DC tests with less than the largest number of CCs supported by the UE.

For LAA SCell(s) with FDD PCell tests specified in 8.2.4.1.1 and 8.3.3.1.1, for each supported CA capability, if corresponding CA with LAA SCell(s) tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA with LAA SCell(s) tests with less than the largest number of CCs supported by the UE.

For LAA SCell(s) with TDD PCell tests specified in 8.2.4.1.2 and 8.3.3.1.2, for each supported CA capability, if corresponding CA with LAA SCell(s) tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA with LAA SCell(s) tests with less than the largest number of CCs supported by the UE.

8.1.2.5 Applicability of performance requirements for Type B receiver

For TM10 capable UE, if corresponding tests specified in 8.3.1.1F, 8.3.2.1G, 9.3.8.3 are tested, the test coverage can be considered fulfilled without executing the tests specified in 8.3.1.1C, 8.3.2.1D, 9.3.8.2. For a UE which does not have TM10 capability, the tests specified in sections 8.3.1.1C, 8.3.2.1D, 9.3.8.2 should be used.

8.1.2.6 Applicability of performance requirements for 4Rx capable UEs

For 4Rx capable UEs, the 2Rx supported RF bands and 4Rx supported RF bands are up to UE's declaration.

8.1.2.6.1 Applicability rule and antenna connection for single carrier tests with 2Rx

For 4Rx capable UEs all single carrier tests specified in 8.2 to 8.8 with 2Rx are tested on any of the 2 Rx supported RF bands by connecting 2 out of the 4Rx with data source from system simulator, and the other 2 Rx are connected with zero input, depending on UE's declaration and AP configuration. Same requirements specified with 2Rx should be applied.

For 4Rx capable UEs without any 2Rx RF bands, all single carrier tests specified in 8.2 to 8.8 with 2Rx are tested on any of the 4Rx supported RF bands by duplicating the fading channel from each Tx antenna and add independent noise for each Rx antenna. Figure 8.1.2.6.1-1 shows an example of antenna connection for 4Rx UE in any one 4Rx supported RF band to perform a 2Rx performance test with antenna configuration as 2x2 without interference for information. The SNR requirements should be applied with 1.5 dB less than the number specified with 2Rx for test configuration with CRS-based TM and with 1.5 dB less than the number specified with 2Rx for test configuration with DMRS-based TM.

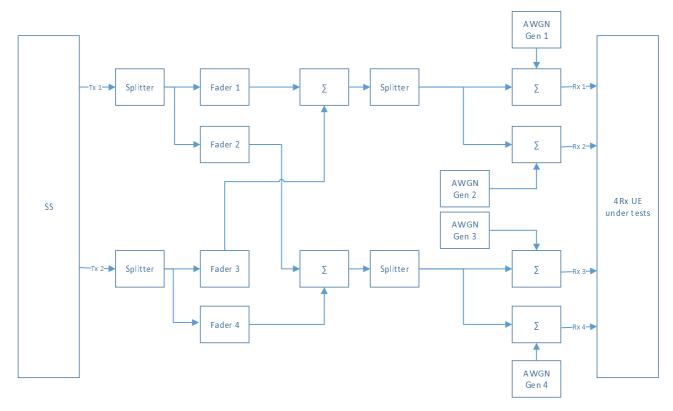


Figure 8.1.2.6.1-1 Antenna connection example for 2Rx tests with antenna configuration as 2x2 without interference (informative)

For 4Rx capable UEs without any 2Rx supported RF bands, for all single carrier tests listed in Table 8.1.2.6.1-0 specified from 8.2 to 8.8 with 2Rx can be skipped.

Table 8.1.2.6.1-0: Requirement lists for 4Rx capable UEs

Requirement lists
Enhanced downlink control channel performance requirements type A
Enhanced downlink control channel performance requirements type B
Enhanced performance requirements type B
Enhanced performance requirements type C
Requirements with demodulation subframe overlaps with aggressor cell ABS
Requirements with demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are
configured
Requirements with CRS assistance information configured

For 4Rx capable UEs, if corresponding tests listed from the 4Rx test lists from Table 8.1.2.6.1-1 are tested, the test coverage can be considered fulfilled without executing the corresponding tests listed from the 2Rx test lists from Table 8.1.2.6.1-1.

Table 8.1.2.6.1-1: Applicability rules for single carrier tests with 2Rx

4Rx test lists	2Rx test lists
8.10.1.1.1 Test 1	8.2.1.2.1 Test 1
8.10.1.1.2 Test 1	8.2.1.3.1 Test 1
8.10.1.1.3 Test 1	8.2.1.4.1B Test 1
8.10.1.1.4 Test 1	8.2.1.4.2 Test 1
8.10.1.1.4 Test 2	8.2.1.4.2 Test 3
8.10.1.1.5 Test 1	8.3.1.1A Test 1
8.10.1.1.5A Test 1	8.3.1.1 Test 2
8.10.1.1.5B Test 1	8.3.1.1H Test 1
8.10.1.1.6 Test 1	8.3.1.2 Test 1
8.10.1.2.1 Test 1	8.2.2.2.1 Test 1
8.10.1.2.2 Test 1	8.2.2.3.1 Test 1
8.10.1.2.3 Test 1	8.2.2.4.1B Test 1
8.10.1.2.4 Test 1	8.2.2.4.2 Test 1
8.10.1.2.4 Test 2	8.2.2.4.2 Test 3
8.10.1.2.5 Test 1	8.3.2.1B Test 1
8.10.1.2.5A Test 1	8.3.2.1A Test 2
8.10.1.2.5B Test 1	8.3.1.1I Test 1
8.10.1.2.6 Test 1	8.3.2.2 Test 2
8.10.2.1.1 Test 1	8.4.1.1 Test 1
8.10.2.1.2 Test 1	8.4.1.2.1 Test 1
8.10.2.1.3 Test 1	8.4.1.2.2 Test 1
8.10.2.2.1 Test 1	8.4.2.1 Test 1
8.10.2.2.2 Test 1	8.4.2.2.1 Test 1
8.10.2.2.3 Test 1	8.4.2.2.2 Test 1
8.10.3.1.1 Test 1	8.5.1.1 Test 1
8.10.3.1.2 Test 1	8.5.1.2.1 Test 1
8.10.3.1.3 Test 1	8.5.1.2.2 Test 1
8.10.3.2.1 Test 1	8.5.2.1 Test 1
8.10.3.2.2 Test 1	8.5.2.2.1 Test 1
8.10.3.2.3 Test 1	8.5.2.2.2 Test 1
8.10.4.1.1 Test 1	8.8.1.1 Test 1
8.10.4.1.1 Test 2	8.8.1.1 Test 2
8.10.4.1.2 Test 1	8.8.1.2 Test 1
8.10.4.1.2 Test 2	8.8.1.2 Test 2
8.10.4.2.1 Test 1	8.8.2.1 Test 1
8.10.4.2.1 Test 2	8.8.2.1 Test 2
8.10.4.2.2 Test 1	8.8.2.2 Test 1
8.10.4.2.2 Test 2	8.8.2.2 Test 2

8.1.2.6.2 Applicability rule and antenna connection for CA and DC tests with 2Rx

All tests specified in 8.2 to 8.8 with 2Rx with CA, TDD-FDD CA and DC are tested with 4 Rx capable UEs.

Within the CA/DC configuration if any of the PCell and/or the SCells and/or PSCells is a 2Rx supported RF band, the antenna connection should follow the same method as defined in 8.1.2.6.1 for single carrier tests on any of the 2Rx supported RF bands, with same requirements specified with 2Rx applied. Within the CA configuration if any of the PCell and/or the SCells and/or PSCells is a 4Rx supported RF band, the antenna connection should follow the same as defined in 8.1.2.6.1 for single carrier tests on any of the 4 Rx supported RF bands, with the SNR requirements applied with 1.5 dB less than the number specified with 2Rx.

Same applicability rules defined in 8.1.2.3, 8.1.2.3A, and 8.1.2.3B for CA, TDD-FDD CA and DC applied for different CA and DC configurations and bandwidth combination sets should be applied for 4 Rx capable UEs

8.1.2.6.3 Applicability rule and antenna connection for single carrier tests with 4Rx

For 4Rx capable UEs all single carrier tests specified in 8.10 with 4Rx are tested on any of the 4Rx supported RF bands by connecting all 4Rx with data source from system simulator.

8.1.2.6.4 Applicability rule for 256QAM tests

For 256QAM capable UE, if corresponding tests specified in 8.10.1.1.4 Test 2 and 8.10.1.2.4 Test 2 are tested, the test coverage can be considered fulfilled without executing the tests specified in 8.10.1.1.4 Test 1 and 8.10.1.2.4 Test 1. For a UE which does not have 256QAM capability, the test specified in 8.10.1.1.4 Test 1 and 8.10.1.2.4 Test 1 should be used.

8.1.2.7 Applicability of Enhanced Downlink Control Channel Performance Requirements

For enhanced Downlink Control Channel Type A receiver capable UE the tests from the Type A receiver test lists from Table 8.1.2.7-1 should be applied and for enhanced Downlink Control Channel Type B receiver capable UE the tests from the Type B receiver test lists Table 8.1.2.7-1 should be applied.

For enhanced Downlink Control Channel Type B receiver capable UE if the tests from the Type B receiver test lists are tested, the test coverage can be considered fulfilled without executing the corresponding tests from the Type A receiver test lists

Table 8.1.2.7-1: Applicability rules for enhanced downlink control channel performance requirements

Test category		Type A receiver test list	Type B receiver test list
FDD Tests	PDCCH/PCFICH	8.4.1.2.5 Test 1	8.4.1.2.5 Test 1 8.4.1.2.7 Test 1
		8.4.1.2.6 Test 1	8.4.1.2.8 Test 1
	PHICH	8.5.1.2.5 Test 1	8.5.1.2.5 Test 1 8.5.1.2.7 Test 1
		8.5.1.2.6 Test 1	8.5.1.2.8 Test 1
	EPDCCH	8.8.4.1 Test 1	8.8.4.1 Test 1
		8.8.6.1 Test 1	8.8.6.1 Test 1
TDD Tests	PDCCH/PCFICH	8.4.2.2.5 Test 1	8.4.2.2.7 Test 1
		8.4.2.2.6 Test 1	8.4.2.2.8 Test 1
	PHICH	8.5.2.2.5 Test 1	8.5.2.2.7 Test 1
		8.5.2.2.6 Test 1	8.5.2.2.8 Test 1
	EPDCCH	8.8.4.2 Test 1	8.8.4.2 Test 1
		8.8.5.1 Test 1	8.8.5.1 Test 1

8.1.2.8 Applicability of performance requirements for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

For a UE which supports DMRS enhancement (dmrs-Enhancements-r13 UE-EUTRA-Capability [7]), if corresponding tests specified in 8.3.1.1H Test 1 and 8.3.2.1I Test 1 are tested, the test coverage can be considered fulfilled without executing the tests specified in 8.3.1.1 Test 2 and 8.3.2.1A Test 2. For a UE which does not have DMRS enhancement capability, the test specified in in 8.3.1.1 Test 2 and 8.3.2.1A Test 2 should be used.

8.1.2.8A Applicability of performance requirements for UE supporting coverage enhancement

The applicability and test rules are defined for the tests for UE supporting coverage enhancement with narrowband transmission in Table 8.1.2.8A-1 and 8.1.2.8A-2.

Table 8.1.2.8A-1: Applicability rules for PDSCH requirements (FDD)

	ue-Category or UE-CategoryDL			
UE-EUTRA-Capability	M1, Cat-0, 1bis	>=1 (Note 1)		
ce-ModeA-r13	8.11.1.1.1 Test 1 8.11.1.1.2.1 Test 1 8.11.1.1.3.1 Test 2	8.11.1.1.2.1 Test 2 8.11.1.1.2.1 Test 3		
ce-ModeB-r13	8.11.1.1.1 Test 1 8.11.1.1.2.1 Test 1 8.11.1.1.3.1 Test 1	8.11.1.1.2.1 Test 2 8.11.1.1.2.1 Test 3 8.11.1.1.3.1 Test 3 8.11.1.1.3.1 Test 4		

Note 1: which test case applies to the UE depends on the supported receiver antenna number.

Table 8.1.2.8A-2: Applicability rules for PDSCH requirements (TDD)

	ue-Category or UE-CategoryDL			
UE-EUTRA-Capability	M1, Cat-0, 1bis	>=1 (Note 1)		
ce-ModeA-r13	8.11.1.2.1.1 Test 1 8.11.1.2.2.1 Test 1 8.11.1.2.3.1 Test 2	8.11.1.2.2.1 Test 2 8.11.1.2.2.1 Test 3		
ce-ModeB-r13	8.11.1.2.1.1 Test 1 8.11.1.2.2.1 Test 1 8.11.1.2.3.1 Test 1	8.11.1.2.2.1 Test 2 8.11.1.2.2.1 Test 3 8.11.1.2.3.1 Test 3 8.11.1.2.3.1 Test 4		

Note 1: which test case applies to the UE depends on the supported receiver antenna number.

8.1.3 UE category and UE DL category

UE category and UE DL category refer to *ue-Category* and *ue-CategoryDL* define in 4.1 and 4.1A from [12]. A UE that belongs to either a UE category or a UE DL category indicated in UE performance requirements in subclause 8, 9, 10 shall fulfil the corresponding requirements.

A UE indicating DL category 13 may indicate category 9 or 10 and shall thereby fulfil all requirements in subclause 8, 9, 10 that are indicated for either cat 9 or DL Cat 13 UEs. For SDR tests in section 8.7 both cat 9 and cat 13 test shall be used for this UE while for the other test only Cat 13 tests needs to be done.

8.2 Demodulation of PDSCH (Cell-Specific Reference Symbols)

8.2.1 FDD (Fixed Reference Channel)

The parameters specified in Table 8.2.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.2.1-1: Common Test Parameters (FDD)

Parameter	Unit	Value
Inter-TTI Distance		1
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths unless otherwise stated
Cyclic Prefix		Normal
Cell_ID		0
Cross carrier scheduling		Not configured

8.2.1.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.3 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

8.2.1.1.1 Minimum Requirement

For single carrier, the requirements are specified in Table 8.2.1.1.1-2, with the addition of the parameters in Table 8.2.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.1.1.1-4, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 3 DL CCs, the requirements are speicifed in Table 8.2.1.1.1-6, based on single carrier requirement speicified in Table 8.2.1.1.1-5, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 4 DL CCs, the requirements are speicifed in Table 8.2.1.1.1-7, based on single carrier requirement speicified in Table 8.2.1.1.1-5, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 5 DL CCs, the requirements are speicified in Table 8.2.1.1.1-8, based on single carrier requirement speicified in Table 8.2.1.1.1-5, with the addition of the parameters in Table 8.2.1.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.1.1-1: Test Parameters

Paramete	r	Unit	Test 1- 5	Test 6-8	Test 9- 15	Test 16- 18	Test 19
Davinlink navian	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)				
	σ	dB	0	0	0	0	0
N_{oc} at antenna	a port	dBm/15kHz	-98	-98	-98	-98	-98
Symbols for unus	ed PRBs		OCNG (NOTE 2)	OCNG (NOTE 2)	OCNG (NOTE 2)	OCNG (NOTE 2)	OCNG (NOTE 2)
Modulatio	n		QPSK	16QAM	64QAM	16QAM	QPSK
PDSCH transmiss	ion mode		1	1	1	1	1

NOTE 1: $P_{\rm B}=0$.

NOTE 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

NOTE 3: Void. NOTE 4: Void.

Table 8.2.1.1.1-2: Minimum performance (FRC)

				Propa-	Correlation	Reference	value	
Test num.	Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	cate gory
1	10 MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0	≥1
2	10 MHz	R.2 FDD	OP.1 FDD	ETU70	1x2 Low	70	-0.4	≥1
3	10 MHz	R.2 FDD	OP.1 FDD	ETU300	1x2 Low	70	0.0	≥1
4	10 MHz	R.2 FDD	OP.1 FDD	HST	1x2	70	-2.4	≥1
5	1.4 MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	0.0	≥1
	10 MHz	R.3 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	≥2
6	5 MHz	R.3-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	1
6	5 MHz (NOTE 4)	R.3-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	6.7	≥2
	10 MHz	R.3 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	≥2
7	5 MHz	R.3-1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	1
'	5 MHz (NOTE 4)	R.3-1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.4	≥2
	10 MHz	R.3 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	≥2
8	5 MHz	R.3-1 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	1
0	5 MHz (NOTE 4)	R.3-1 FDD	OP.1 FDD	ETU300	1x2 High	70	9.4	≥2
9	3 MHz	R.5 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.6	≥1
40	5 MHz	R.6 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.4	≥2
10	5 MHz	R.6-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.5	1
4.4	10 MHz	R.7 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.7	≥2
11	10 MHz	R.7-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.7	1
40	10 MHz	R.7 FDD	OP.1 FDD	ETU70	1x2 Low	70	19.0	≥2
12	10 MHz	R.7-1 FDD	OP.1 FDD	ETU70	1x2 Low	70	18.1	1
40	10 MHz	R.7 FDD	OP.1 FDD	EVA5	1x2 High	70	19.1	≥2
13	10 MHz	R.7-1 FDD	OP.1 FDD	EVA5	1x2 High	70	17.8	1
4.4	15 MHz	R.8 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.7	≥2
14	15 MHz	R.8-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.8	1
	20 MHz	R.9 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.6	≥3
15	20 MHz	R.9-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	17.3	2
	20 MHz	R.9-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	16.7	1
16	3 MHz	R.0 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	≥1
17	10 MHz	R.1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	≥1
18	20 MHz	R.1 FDD	OP.1 FDD	ETU70	1x2 Low	30	1.9	≥1
19	10 MHz	R.41 FDD	OP.1 FDD	EVA5	1x2 Low	70	-5.4	≥1
NOTE (1. \/oid		•		•	•		

NOTE 1: Void.

NOTE 2: Void.
NOTE 3: Void.
NOTE 4: Test case applicability is defined in 8.1.2.1.

Table 8.2.1.1.1-3: Test Parameters for CA

Pai	Parameter		Value
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
allocation	σ	dB	0
N_{oc} at a	N_{oc} at antenna port		-98
Symbols for unused PRBs			OCNG (NOTE 2)
Modulation			QPSK
PDSCH trai	nsmission mode		1

NOTE 1: $P_{\scriptscriptstyle B}=0$.

NOTE 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

NOTE 3: PUCCH format 1b with channel selection is used to feedback ACK/NACK for Tests in Table 8.2.1.1.1-4, PUCCH format 3 is used to feedback ACK/NACK for Tests in Table 8.2.1.1.1-6.

NOTE 4: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.1.1-4: Minimum performance (FRC) for CA with 2DL CCs

				Propa	Correlatio	Reference	e value	
Test num.	Band- width	Reference channel	OCNG pattern	gation condi- tion	n matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	2x10 MHz	R.2 FDD	OP.1 FDD (NOTE 1)	EVA5	1x2 Low	70	-1.1	≥3 (NOTE 2)
2	2x20 MHz	R.42 FDD	OP.1 FDD (NOTE 1)	EVA5	1x2 Low	70	-1.3	≥5
	2x5		OP.1 FDD	_,,,,_		70	-1.0	
3	MHz	R.42-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0	≥2
	40141-	R.2 FDD for 10MHz CC	OP.1 FDD			70	-1.7	
4	10MHz +5MHz	R.42-2 FDD for 5MHz CC	OP.1 FDD	EVA5	1x2 Low	70	-1.0	≥3
5	15MHz	R.42-3 FDD for 15MHz CC	OP.1 FDD	EVA5	1x2 Low	70	-1.6	≥3
5	+5MHz	R.42-2 FDD for 5MHz CC	OP.1 FDD	EVAS	TXZ LOW	70	-1.0	23

NOTE 1: The OCNG pattern applies for each CC.

NOTE 2: 30usec timing difference between two CCs is applied in inter-band CA case.

NOTE 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.1.1.1-5: Single carrier performance for multiple CA configurations

				Correlation	Reference va	lue
Band- width	Reference channel	OCNG pattern	Propagation condition	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.3
3MHz	R.42-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.1
5MHz	R.42-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0
10MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7
15MHz	R.42-3 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.6
20MHz	R.42 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7

Table 8.2.1.1.1-6: Minimum performance (FRC) based on single carrier performance for CA with 3DL CCs

Test num.	CA Band-width combination	Requirement	UE category
1	3x20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
2	20MHz+20MHz+15MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
3	20MHz+20MHz+10MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
4	20MHz+15MHz+15MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
5	20MHz+15MHz+10MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
6	20MHz+10MHz+10MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
7	15MHz+15MHz+10MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
8	20MHz+10MHz+5MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
9	20MHz+15MHz+5MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5
10	10MHz+10MHz+5MHz	As specified in Table 8.2.1.1.1-5 per CC	≥5

NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3

NOTE 2: 30usec timing difference between PCell and any SCell, which is not within the same band or sub-block as PCell, is applied in inter-band CA case, where PCell can be assigned on any CC.

Table 8.2.1.1.1-7: Minimum performance (FRC) based on single carrier performance for CA with 4DL CCs

Test num.	CA Band-width combination	Requirement	UE category
1	4x20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥8
2	10MHz+20MHz+20MHz+20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥8
3	10MHz+10MHz+20MHz+20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥8
4	5MHz+10MHz+20MHz+20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥8
5	5MHz+10MHz+10MHz+20MHz	As specified in Table 8.2.1.1.1-5 per CC	≥8

NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3

NOTE 2: 30usec timing difference between PCell and any SCell, which is not within the same band or sub-block as PCell, is applied in inter-band CA case, where PCell can be assigned on any CC.

Table 8.2.1.1.1-8: Minimum performance (FRC) based on single carrier performance for CA with 5DL CCs

Test num.	CA Band-width combination	Requirement	UE category						
1	5x20MHz	As specified in Table 8.2.1.1.1-5 per CC	8, ≥11						
	NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3								
	3	Cell and any SCell, which is not within the sa r-band CA case, where PCell can be assigne							

8.2.1.1.2 Void

8.2.1.1.3 Void

8.2.1.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.1.1.4-2, with the addition of the parameters in Table 8.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

Table 8.2.1.1.4-1: Test Parameters for Testing 1 PRB allocation

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
	σ	dB	0
N_{oc} at antenna	port	dBm/15kHz	-98
Symbols for MBSFN MBSFN subframes (OCNG (NOTE 3)
PDSCH transmission	on mode		1

NOTE 1: $P_B = 0$

NOTE 2: The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the

first slot.

NOTE 3: The MBSFN portion of the MBSFN subframes shall contain QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN subframes,

QPSK modulated MBSFN data is used instead.

Table 8.2.1.1.4-2: Minimum performance 1PRB (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE
number		Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Category
					Antenna	Maximum	(dB)	
					Configuration	Throughput		
						(%)		
1	10 MHz	R.29 FDD	OP.3 FDD	ETU70	1x2 Low	30	2.0	≥1

8.2.1.2 Transmit diversity performance

8.2.1.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.1-2, with the addition of the parameters in Table 8.2.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.2.1.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2		
	$ ho_{\scriptscriptstyle A}$	dB	-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)		
	σ	dB	0		
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98		
PDSCH transmission	on mode		2		
NOTE 1: $P_B = 1$.					

Table 8.2.1.2.1-2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughp ut (%)	SNR (dB)	Category
1	10 MHz	R.11 FDD	OP.1 FDD	EVA5	2x2 Medium	70	6.8	≥2
	5 MHz	R.11-2 FDD	OP.1 FDD	EVA5	2x2 Medium	70	5.9	1
	5 MHz (NOTE 1)	R.11-2 FDD	OP.1 FDD	EVA5	2x2 Medium	70	5.9	≥2
2	10 MHz	R.10 FDD	OP.1 FDD	HST	2x2	70	-2.3	≥1
NOTE 1:	Test case a	pplicability is de	efined in 8.1.2.	1.		•		

8.2.1.2.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.2.2-2, with the addition of the parameters in Table 8.2.1.2.2-1 and the downlink physical channel setup according Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.1.2.2-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter	•	Unit	Test 1-2			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)			
	σ	dB	0			
N_{oc} at antenna	port	dBm/15kHz	-98			
PDSCH transmission	on mode		2			
NOTE 1: $P_B = 1$.						

Table 8.2.1.2.2-2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	a Maximum tion Throughput (%)		Category
1	1.4 MHz	R.12 FDD	OP.1 FDD	EPA5	4x2 Medium	70	0.6	≥1
2	10 MHz	R.13 FDD	OP.1 FDD	ETU70	4x2 Low	70	-0.9	≥1

8.2.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.1.2.3-2, with the addition of parameters in Table 8.2.1.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.1.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	-3
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (NOTE 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (NOTE 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (NOTE 4)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.1.2.3-2	6
BW _{Channel}		MHz	10	10
Subframe Configura	tion		Non-MBSFN	Non-MBSFN
Time Offset between	Cells	μs	2.5 (synchron	nous cells)
Cell Id			0	1
ABS pattern (NOTE	E 5)		N/A	11000100 11000000 11000000 11000000 11000000
RLM/RRM Measurement Pattern (NOTE 6			1000000 1000000 1000000 1000000 1000000	N/A
CSI Subframe Sets	Ccsi,0		11000100 11000000 11000000 11000000 11000000	N/A
(NOTE7)	C _{CSI,1}		00111011 00111111 00111111 00111111 00111111	N/A
Number of control OFDM			2	2
PDSCH transmission	mode		2	N/A
Cyclic prefix			Normal	Normal

- NOTE 1: $P_B = 1$.
- NOTE 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- NOTE 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- NOTE 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- NOTE 5: ABS pattern as defined in [9].
- NOTE 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- NOTE 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- NOTE 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- NOTE 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.1.2.3-2: Minimum Performance Transmit Diversity (FRC)

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions (NOTE 1)		Conditions Matrix and		Matrix and Cat	
		Cell 1	Cell 2	Cell 1	Cell 2	Configurati on	Fraction of Maximum Throughput (%) NOTE 5	SNR (dB) (Note 2)	
1	R.11-4 FDD (NOTE 4)	OP.1 FDD	OP.1 FDD	EVA5	EVA 5	2x2 Medium	70	3.4	≥2

- NOTE 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.
- NOTE 2: SNR corresponds to \widehat{E}_s/N_{oc2} of cell 1.
- NOTE 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.
- NOTE 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- NOTE 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

8.2.1.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.2.3A-2, with the addition of parameters in Table 8.2.1.2.3A-1. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cells with CRS assistance information. In Table 8.2.1.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.1.2.3A-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	-3 (NOTE 1)	-3 (NOTE 1)
	σ	dB	0	N/A	N/A
	N_{oc1}	dBm/15kHz	-98 (NOTE 2)	N/A	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (NOTE 3)	N/A	N/A
	N_{oc3}	dBm/15kHz	-93 (NOTE 4)	N/A	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table8.2.1.2.3 A-2	12	10
BW _{Channel}		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	en Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (NO	ΓE 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000
RLM/RRM Measur Subframe Pattern (N			10000000 10000000 10000000 10000000 1000000	N/A	N/A
CSI Subframe Sets	C _{CSI,0}		11000000 11000000 11000000 11000000 11000000	N/A	N/A
(NOTE 7)	Ccsi,1		00111111 00111111 00111111 00111111 00111111	N/A	N/A
Number of control of symbols	OFDM		2	NOTE 8	NOTE 8
PDSCH transmissio	n mode		2	NOTE 9	NOTE 9
Cyclic prefix			Normal	Normal	Normal

- NOTE 1: $P_B = 1$.
- NOTE 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.
- NOTE 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- NOTE 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- NOTE 5: ABS pattern as defined in [9].
- NOTE 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- NOTE 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- NOTE 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- NOTE 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
- NOTE 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
- NOTE 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.1.2.3A-2: Minimum Performance Transmit Diversity (FRC)

Test Number	Reference Channel	OC	OCNG Pattern		Propagation Conditions (NOTE 1)		Correlation Matrix and	Reference Value		UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (NOTE 2)	Fraction of Maximum Throughput (%) NOTE 5	SNR (dB) (NOTE 3)	gory
1	R.11-4 FDD NOTE 4	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Medium	70	3.4	≥2

- NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- NOTE 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.
- NOTE 3: SNR corresponds to E_{s}/N_{oc2} of cell 1.
- NOTE 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- NOTE 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

8.2.1.2.4 Enhanced Performance Requirement Type A - 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.1.2.4-2, with the addition of parameters in Table 8.2.1.2.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.1.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (NOTE 2)		dB	N/A	-2.23	-8.06
BW _{Channel}	MHz	10	10	10	
Cyclic Prefix	Cyclic Prefix			Normal	Normal
Cell Id			0	1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission	mode		2	N/A	N/A
Interference mod	el		N/A	As specified in clause B.5.2	As specified in clause B.5.2
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Reporting interva	ıl	ms	5	N/A	N/A
Reporting mode			PUCCH 1-0	N/A	N/A
Physical channel for CQI	Physical channel for CQI reporting		PUSCH(Note 5)	N/A	N/A
cqi-pmi-Configuration	Index		2	N/A	N/A

NOTE 1: $P_B = 1$

NOTE 2: The respective received power spectral density of each interfering cell relative to N_{oc} is defined by its associated DIP value as specified in clause B.5.1.

NOTE 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

NOTE 4: Cell 2 transmission is delayed with respect to Cell 1 by 0.33 ms and Cell 3 transmission is delayed with respect to Cell 1 by 0.67 ms.

Note 5: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5 and #0.

Table 8.2.1.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (NOTE 3)	Fraction of Maximum Throughput (%)	SINR (dB) (NOTE 2)	gory
1	R.46 FDD	OP. 1 FD D	N/A	N/A	EV A70	EV A70	EV A70	2x2 Low	70	-1.1	≥1

NOTE 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

NOTE 2: SINR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.2.1.2.5 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM2 interference model

The requirements are specified in Table 8.2.1.2.5-2, with the addition of parameters in Table 8.2.1.2.5-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 2 interference model defined in clause B.6.1. In Table 8.2.1.2.5-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.2.5-1: Test Parameters for Transmit Diversity Performance (FRC) with TM2 interference model

Para	meter		Unit	Cell 1	Cell 2	Cell 3
		$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation		$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
		σ	dB	0	0	0
Cell-specific reference	Cell-specific reference signals			Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port			dBm/15kHz		-98	
\hat{E}_s/N_{oc}			dB	N/A	13.91	3.34
BWchannel			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	6	1
Number of control Of	FDM sym	bols		3	3	3
CFI indicated in PCF	TCH			3	3	3
PDSCH transmission	n mode			2	2	2
Interference model				N/A	As specified in clause B.6.1	As specified in clause B.6.1
MBSFN				Not configured	Not configured	Not configured
Time offset to cell 1			us	N/A	2	3
Frequency offset to c	ell 1		Hz	N/A	200	300
NeighCellsInfo- r12	p-aList-r	12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 3) transmissionModeList		sionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}
Note 1: $P_{x} = 1$						

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. Note 3:

Table 8.2.1.2.5-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM2 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.11-10 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	15.5	≥1

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 1:

SNR corresponds to E_s/N_{oc} of Cell 1 as defined in clause 8.1.1. Note 2:

Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. Note 3:

8.2.1.2.6 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM9 interference model

The requirements are specified in Table 8.2.1.2.6-2, with the addition of parameters in Table 8.2.1.2.6-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In Table 8.2.1.2.6-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.2.6-1: Test Parameters for Transmit Diversity Performance (FRC) with TM9 interference model

Paran	neter	Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	0	0
Downlink power alloca	tion $ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	0	0
	σ	dB	0	-3	-3
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port		dBm/15kHz		-98	
\hat{E}_s/N_{oc}		dB	N/A	3.28	0.74
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Number of control OFI	OM symbols		3	3	3
CFI indicated in PCFIC	СН		3	Random from set {1,2,3}	Random from set {1,2,3}
PDSCH transmission i	mode		2	9	9
Interference model			N/A	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signals			N/A	Antenna ports 15,16	Antenna ports 15,16
CSI-RS periodicity and $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$	d subframe offset	Subframes	N/A	10 / 1	10 / 1
CSI reference signal c	onfiguration		N/A	6	7
Zero-power CSI-RS co I _{CSI-RS} / ZeroPowerCS		Subframes / bitmap	N/A	6 / 01000000000 00000	6 / 0010000000 000000
Time offset to cell 1		us	N/A	5	-5
Frequency offset to ce	II 1	Hz	N/A	600	-600
MBSFN			Not configured	Not configured	Not configured
r12	aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4) tra	nsmissionModeList- 2		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1: $P_B = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.2.1.2.6-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM9 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.11-9 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	8.4	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \widehat{E}_{s}/N_{ac} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.2.1.3 Open-loop spatial multiplexing performance

8.2.1.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier, the requirements are specified in Table 8.2.1.3.1-2, with the addition of the parameters in Table 8.2.1.3.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CC, the requirements are specified in Table 8.2.1.3.1-4, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.1.3.1-6, based on single carrier requirement specified in Table 8.2.1.3.1-5, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 4 DL CCs, the requirements are specified in Table 8.2.1.3.1-7, based on single carrier requirement specified in Table 8.2.1.3.1-5, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 5 DL CCs, the requirements are specified in Table 8.2.1.3.1-8, based on single carrier requirement specified in Table 8.2.1.3.1-5, with the addition of the parameters in Table 8.2.1.3.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.3.1-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1-4
Develiels never	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{\it oc}$ at antenna	N_{oc} at antenna port		-98
PDSCH transmission	on mode		3
NOTE 4 P. 4	•		<u> </u>

NOTE 1: $P_B = 1$. NOTE 2: Void. NOTE 3: Void.

Table 8.2.1.3.1-2: Minimum performance Large Delay CDD (FRC)

				Propa-	Correlation	Reference	value	
Test num	Bandwidt h	Referenc e channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE cate gory
1 (NOTE 4)	10 MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Low	70	13.0	≥2
2 (NOTE 3)	5 MHz	R.11-2 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.7	≥2
3	10 MHz	R.35 FDD	OP.1 FDD	EVA200	2x2 Low	70	20.2	≥2
4	10 MHz	R.35-4 FDD	OP.1 FDD	ETU600	2x2 Low	70	20.8	≥2

NOTE 1: Void.

NOTE 2: Test 1 may not be executed for UE-s for which Test 1 or 2 in Table 8.2.1.3.1-4 is applicable.

NOTE 3: Test case applicability is defined in 8.1.2.1.

NOTE 4: For UE that supports CRS interference handling, the CRS assistance information defined in [7] is provided. The CRS assistance information includes two aggressor cells with 2 CRS ports and cell ID of agressor cells are 1 and 128. For UE that does not support CRS interference handling, CRS assistance information is not provided.

Table 8.2.1.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

Parameter		Unit	Value
Davidial access	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
N_{oc} at antenna port		dBm/15kHz	-98
PDSCH transmission	on mode		3

NOTE 1: $P_B = 1$.

NOTE 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK for Tests in Table 8.2.1.3.1-4, PUCCH format 3 is used to feedback ACK/NACK for Tests in Table 8.2.1.3.1-6.

NOTE 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.3.1-4: Minimum performance Large Delay CDD (FRC) for CA with 2DL CCs

				Propa-	Correlation	Referenc	e value		
Test num	Bandwidth	Referenc e channel	3		matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE category	
1 (NOTE 2)	2x10 MHz	R.11 FDD	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.7	≥3	
2 (NOTE 2)	2x20 MHz	R.30 FDD	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.2	≥5	
3	2x5 MHz	R.11-2 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.7	≥2	
4	10MHz+5	R.11 FDD for 10MHz CC,	OP.1 FDD (NOTE 1)	E\/\\ 70	2021 200	70	13.0	,,	
4	MHz		ZXZ LOW	70	12.7	- ≥3			
5	15MHz+5	R.11-7 FDD for 15MHz CC	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	12.8	≥3	
	o MHz	R.11-2 FDD for 5MHz CC	OP.1 FDD (NOTE 1)			70	12.7		

NOTE 1: The OCNG pattern applies for each CC.

NOTE 2: Void

NOTE 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.1.3.1-5: Single carrier performance for multiple CA configurations

			Propa- Co		Reference val	ue
Band- width	Reference channel	OCNG pattern	gation condition	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.11-5 FDD	OP. 1 FDD	EVA70	2x2 Low	70	13.6
3MHz	R.11-6 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.3
5MHz	R.11-2 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.3
10 MHz	R.11 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.9
15MHz	R.11-7 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.8
20MHz	R.30 FDD	OP. 1 FDD	EVA70	2x2 Low	70	12.9

Table 8.2.1.3.1-6: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

Test num.	CA Band-width combination	Requirement	UE category
1	3x20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
2	20MHz+20MHz+15MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
3	20MHz+20MHz+10MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
4	20MHz+15MHz+15MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
5	20MHz+15MHz+10MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
6	20MHz+10MHz+10MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
7	15MHz+15MHz+10MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
8	20MHz+10MHz+5MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
9	20MHz+15MHz+5MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5
10	10MHz+10MHz+5MHz	As specified in Table 8.2.1.3.1-5 per CC	≥5

NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3

Table 8.2.1.3.1-7: Minimum performance (FRC) based on single carrier performance for CA with 4 DL CCs

Test num.	CA Band-width combination	Requirement	UE category						
1	4x20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥8						
2	10MHz+20MHz+20MHz+20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥8						
3	10MHz+10MHz+20MHz+20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥8						
4	5MHz+10MHz+20MHz+20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥8						
5	5MHz+10MHz+10MHz+20MHz	As specified in Table 8.2.1.3.1-5 per CC	≥8						
NOTE 1: T	NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination								
S	ets is defined in 8 1 2 3								

Table 8.2.1.3.1-8: Minimum performance (FRC) based on single carrier performance for CA with 5 DL CCs

Test num.	CA Band-width combination	Requirement	UE category	
1	5x20MHz	As specified in Table 8.2.1.3.1-5 per CC	8, ≥11	
NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination				
sets is defined in 8.1.2.3				

8.2.1.3.1A Soft buffer management test

For CA, the requirements are specified in Table 8.2.1.3.1A-2, with the addition of the parameters in Table 8.2.1.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.2.1.3.1A-3.

Table 8.2.1.3.1A-1: Test Parameters for soft buffer management test (FRC) for CA

Parameter		Unit	Test 1-7
December a second	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{\it oc}$ at antenna port		dBm/15kHz	-98
PDSCH transmission mode			3

NOTE 1: $P_B = 1$.

NOTE 2: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK.

NOTE 3: For CA test cases, the same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.3.1A-2: Minimum performance soft buffer management test (FRC) for CA

						Reference value	
Test num	Bandwi dth	Reference channel	OCNG pattern	Propa- gation condition	Correlation matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)
1	2x20 MHz	R.30 FDD	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.2
2	2 15MHz + 10MHz	R.35-2 FDD for 15MHz CC	OP.1 FDD (NOTE 1)	EVA5	2x2 Low	70	15.1
2		R.35-3 FDD for 10MHz CC	OP.1 FDD (NOTE 1)			70	15.1
2	3 20MHz + 10MHz	R.30 FDD for 20MHz CC	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.5
3		R.11 FDD for 10MHz CC	OP.1 FDD (NOTE 1)			70	13.5
4	4 20MHz + 15MHz	R.30 FDD for 20MHz CC	OP.1 FDD (NOTE 1)	EVA70	2x2 Low	70	13.5
4		R.30-1 FDD for 15MHz CC	OP.1 FDD (NOTE 1)			70	13.5
5	2x20 MHz	R.35-1 FDD	OP.1 FDD (NOTE 1)	EVA5	2x2 Low	70	15.8
6	20MHz +	R.35-1 FDD for 20MHz CC	OP.1 FDD (NOTE 1)	EVA5	2x2 Low	70	15.9
10MHz	10MHz	R.35-3 FDD for 10MHz CC	OP.1 FDD (NOTE 1)			70	15.9
7	20MHz +	R.35-1 FDD for 20MHz CC	OP.1 FDD (NOTE 1)	EVA5	2x2 Low	70	15.9
/	15MHz	R.35-2 FDD for 15MHz CC	OP.1 FDD (NOTE 1)			70	15.9

NOTE 1: For CA test cases, the OCNG pattern applies for each CC.

NOTE 2: For Test 2, 3, 4, 6, 7 the Fraction of maximum Throughput applies to each CC.

NOTE 3: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.1.3.1A-3: Test points for soft buffer management tests for CA

LIE optogory	Bandwidth combination with maximum aggregated bandwidth (NOTE 1)				
UE category	2x20MHz	15MHz+10MHz	20MHz+10MHz	20MHz+15MHz	
3	1	2	3	4	
4 5		N/A	6	7	
NOTE 1: Maximum over all supported CA configurations and bandwidth combination sets according to Table 5.6A.1-					

8.2.1.3.1B Enhanced Performance Requirement Type C –2Tx Antenna Ports

The requirements are specified in Table 8.2.1.3.1B-2, with the addition of the parameters in Table 8.2.1.3.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

Table 8.2.1.3.1B-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1	
Develiels nesses	$ ho_{\scriptscriptstyle A}$	dB	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	
	σ	dB	0	
$N_{\it oc}$ at antenna port		dBm/15kHz	-98	
PDSCH transmission mode			3	
NOTE 1: $P_{R} = 1$.				

Table 8.2.1.3.1B-2: Enhanced Performance Requirement Type C for Large Delay CDD (FRC)

				Propa-	Correlation	Reference		
Test num	Bandwidt h	Referenc e channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	UE cate gory
1	10 MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Medium	70	17.8	≥2

8.2.1.3.1C Enhanced Performance Requirement Type C - 2 Tx Antenna Ports with TM1 interference

The requirements are specified in Table 8.2.1.3.1C-2, with the addition of parameters in Table 8.2.1.3.1C-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of open-loop spatial multiplexing performence with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell with transmission mode 1. In Table 8.2.1.3.1C-1, Cell 1 is the serving cell, and Cell 2 is interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2 respectively.

Table 8.2.1.3.1C-1 Test parameters for Larger Delay CDD (FRC) with TM1 interference

Parame	ter	Unit	Cell 1	Cell 2	
Bandwid	dth	MHz	10 M	Hz	
Downlink	$ ho_{\scriptscriptstyle A}$		-3	0	
power	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	0	
allocation	σ		0	0	
Cell-spec			Antenna	Antenna	
reference s			ports 0,1 Normal	port 0	
Cyclic Pr				Normal 1	
Cell IE			0	1	
Transmis: mode			3	NOTE 2	
$N_{\!oc}$ at anteni	na port	dBm/15kHz	-98	N/A	
\hat{E}_s/N_{oc} (NC	OTE 3)	dB	Reference Value in Table 8.2.1.3.1C-2	12.95	
Correlatior antenn configura	а		Medium (2x2)	Medium(1x 2)	
Number of 0 symbols PDCCI	for		2	N/A	
Max number of HARQ transmissions			4	N/A	
Redunda version co sequen	ding		{0,1,2,3}	N/A	

NOTE 1: $P_B = 1$

NOTE 2: Downlink physical channel setup in Cell 2 in

accordance with Annex C.3.2 applying OCNG pattern

OP.5 FDD as defined in Annex A.5.1.5.

NOTE 3: Cell 1 is the serving cell. Cell 2 is the interfering cell.

NOTE 4: All cells are time-synchronous.

NOTE 5: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.1.3.1C-2 Enhanced Performance Requirement Type C, Larger Delay CDD (FRC) with TM1 interference

Test Number	Reference Channel		NG tern	Propagation Conditions (NOTE 1)		Reference Value		Reference Value		UE Categor y
		Cell 1	Cell 2	Cell 1	Cell 2	Fraction of Maximum Throughpu t (%)	SNR (dB) (NOTE 2)			
1	R.11-8	OP.1	OP.5	EVA7	EVA7	70	19.9	≥2		
	FDD	FDD	FDD	0	0					

NOTE 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

NOTE 2: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1.

8.2.1.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.3.2-2, with the addition of the parameters in Table 8.2.1.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Table 8.2.1.3.2-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (NOTE 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		3
NOTE 1: $P_B = 1$			

Table 8.2.1.3.2-2: Minimum performance Large Delay CDD (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.14 FDD	OP.1 FDD	EVA70	4x2 Low	70	14.3	≥2

8.2.1.3.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.3-2, with the addition of parameters in Table 8.2.1.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.1.3.3-4, with the addition of parameters in Table 8.2.1.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.1.3.3-1 and 8.2.1.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.1.3.3-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	-3
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (NOTE 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (NOTE 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (NOTE 4)	N/A
\widehat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.1.3.3-2	6
BW _{Channel}		MHz	10	10
Subframe Configura	ation		Non-MBSFN	Non-MBSFN
Cell Id			0	1
Time Offset between	Cells	μs	2.5 (synchro	nous cells)
ABS pattern (NOT	E 5)		N/A	11000100, 11000000, 11000000, 11000000, 11000000
RLM/RRM Measurement Pattern(NOTE 6			1000000 1000000 1000000 1000000 1000000	N/A
CSI Subframe Sets	Ccsi,0		11000100 11000000 11000000 11000000	N/A
(NOTE 7)	C _{CSI,1}		00111011 00111111 00111111 00111111 00111111	N/A
Number of control OFDN			2	2
PDSCH transmission	mode		3	N/A
Cyclic prefix			Normal	Normal

- NOTE 1: $P_B = 1$.
- NOTE 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- NOTE 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- NOTE 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- NOTE 5: ABS pattern as defined in [9].
 NOTE 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- NOTE 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- NOTE 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- NOTE 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.1.3.3-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference \	/alue	UE Category		
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 2)			
1	R.11 FDD Note 4	OP.1 FDD	OP.1 FDD	EVA 5	EVA 5	2x2 Low	70	13.3	≥2		
Note 1:			onditions for Cell 1 and Cell2 are statistically independent.								
Note 2:	SNR correspo	nds to \widehat{E}	N_{oc2}	of cell 1.							

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH Note 4: are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

Note 5:

Table 8.2.1.3.3-3: Test Parameters for Large Delay CDD (FRC) - MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A
\widehat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.1.3.3-4	6
BW _{Channel}		MHz	10	10
Subframe Configura	ation		Non-MBSFN	MBSFN
Cell Id			0	126
Time Offset between	Cells	μs	2.5 (synchro	nous cells)
ABS pattern (Note	: 5)		N/A	0001000000 0100000010 0000001000 0000000
RLM/RRM Measurement Pattern (Note 6			0001000000 0100000010 0000001000 0000000	N/A
CSI Subframe Sets (Note	Ccsi,0		0001000000 0100000010 0000001000 0000000	N/A
7)	Ccsi,1		1110111111 1011111101 1111110111 1111111	N/A
MBSFN Subframe Allocation	,		N/A	001000 100001 000100 000000
Number of control OFDN			2	2
PDSCH transmission Cyclic prefix	mode		3 Normal	N/A Normal
Oyolic pielix		l	Noma	Nomai

- Note 1: $P_B = 1$.
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbol #0 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 5: ABS pattern as defined in [9]. The 4th, 12th, 19th and 27th subframes indicated by ABS pattern are MBSFN ABS subframes.
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.
- Note 10: MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN subframe allocation.
- Note 11: The maximum number of uplink HARQ transmission is ≤ 2 so that each PHICH channel transmission is in a subframe protected by MBSFN ABS in this test.

Table 8.2.1.3.3-4: Minimum Performance Large Delay CDD (FRC) - MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 2)	Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 2)	
1	R.11 FDD Note 4	OP.1 FDD	OP.1 FDD	EVA 5	EVA 5	2x2 Low	70	12.0	≥2
Noto 1:	The propagati	on conditi	iona for C	all 1 and (Calla ara	statictically indone	ndont		•

- Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.
- Note 2: SNR corresponds to E_s/N_{oc2} of cell 1.
- Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.
- Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: The maximum Throughput is calculated from the total Payload in 4 subframes, averaged over 40ms.

8.2.1.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.1.3.4-2, with the addition of parameters in Table 8.2.1.3.4-1. The purpose is to verify the performance of large delay CDD with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cells with CRS assistance information. In Table 8.2.1.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 ad Cell3.

Table 8.2.1.3.4-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A	N/A
	N_{oc1}	dBm/15kHz	-98 (Note 2)	N/A	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A	N/A
	N_{oc3}	dBm/15kHz	-93 (Note 4)	N/A	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.1.3.4-2	Reference Value in Table 8.2.1.3.4-2	Reference Value in Table 8.2.1.3.4-2
BWchannel		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	1	126
ABS pattern (Not	te 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000 1000000	N/A	N/A
CSI Subframe Sets	Ccsi,o		11000000 11000000 11000000 11000000 11000000	N/A	N/A
(Note7)	Ccsi,1		00111111 00111111 00111111 00111111 00111111	N/A	N/A
Number of control of symbols	OFDM		2	Note 8	Note 8
PDSCH transmissio			3	Note 9	Note 9
Cyclic prefix			Normal	Normal	Normal

Note 1: $P_{p} = 1$.

Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.

Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.

Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS

Note 5: ABS pattern as defined in [9].

Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]

Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].

Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.

Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.

Note 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.

Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.1.3.4-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Refer ence	$\hat{E}_s/2$	N_{oc2}	OC	NG Patt	ern		ropagations (N		Correlation Matrix and	Matrix and		UE Cate
	Chan nel	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughp ut (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 FDD Note 4	9	7	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	70	13.9	≥2
2	R.35 FDD Note 4	9	1	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	70	22.6	≥2

- Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.
- Note 3: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.
- Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

8.2.1.4 Closed-loop spatial multiplexing performance

8.2.1.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1-2, with the addition of the parameters in Table 8.2.1.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.1.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1	Test 1A	Test 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98	-98	-98
Precoding granul	larity	PRB	6	4	50
PMI delay (Note	e 2)	ms	8	8	8
Reporting inter	val	ms	1	1	1
Reporting mod	de		PUSCH 1-2	PUSCH 1-2	PUSCH 3-1
CodeBookSubsetR	estricti		001111	001111	001111
on bitmap					
PDSCH transmission			4	4	4
mode					

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test number	Band- width	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference v Fraction of Maximum Throughput (%)	value SNR (dB)	UE Catego ry
1	10 MHz	R.10 FDD	OP.1 FDD	EVA5	2x2 Low	70	-2.5	≥1
1A (Note 1)	5 MHz	R.10-2 FDD	OP.1 FDD	EVA5	2x2 Low	70	-2.9	≥1
2	10 MHz	R.10 FDD	OP.1 FDD	EPA5	2x2 High	70	-2.3	≥1
Note 1: Tes	st case appli	cability is defin	ned in 8.1.2.1.	•			•	

8.2.1.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.1A-2, with the addition of the parameters in Table 8.2.1.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rankone performance with wideband and frequency selective precoding.

Table 8.2.1.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Danielink namer	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
N_{oc} at antenna p	ort	dBm/15kHz	-98
Precoding granula	arity	PRB	6
PMI delay (Note	2)	ms	8
Reporting interv	al	ms	1
Reporting mod	е		PUSCH 1-2
CodeBookSubsetRe on bitmap	estricti		0000000000000000 00000000000000000 00000
PDSCH transmiss mode	sion		4

Note 1: $P_{\scriptscriptstyle R}=1$.

If the UE reports in an available uplink reporting instance Note 2: at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.1A-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

ſ	Test	Band-	Reference	eference OCNG Propagation		Correlation	Reference v	alue	UE
	number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum (dB) Throughput (%) 70 -3.2		Category
	1	10 MHz	R.13 FDD	OP.1 FDD	EVA5	4x2 Low	70	-3.2	≥1

8.2.1.4.1B Enhanced Performance Requirement Type A - Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.1.4.1B-2, with the addition of the parameters in Table 8.2.1.4.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rankone performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.2.1.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (Note 2)		dB	N/A	-1.73	-8.66
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission	mode		6	N/A	N/A
Interference mode	el		N/A	As specified in clause B.5.3	As specified in clause B.5.3
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Precoding granula	rity	PRB	50	6	6
PMI delay (Note 4	1)	ms	8	N/A	N/A
Reporting interval		ms	5	N/A	N/A
Reporting mode			PUCCH 1-1	N/A	N/A
CodeBookSubsetRestricti		1111	N/A	N/A	
Physical channel for CQI	reporting		PUSCH(Note 6)	N/A	N/A
cqi-pmi-Configuration	Index		2	N/A	N/A

Note 1: $P_{B} = 1$

Note 2: The respective received power spectral density of each interfering cell relative to N_{oc} is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 4: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 5: All cells are time-synchronous.

Note 6: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5 and #0.

Table 8.2.1.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		pagat onditio		Correlation Matrix and	Reference	Value	UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 FDD	OP. 1 FD D	N/A	N/A	EV A5	EV A5	EV A5	2x2 Low	70	0.8	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.2.1.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.1.4.1C-2, with the addition of parameters in Table 8.2.1.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.1.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.1.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) – Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
anocation	σ	dB	0	N/A	N/A
	N_{oc1}	dBm/15kHz	-98 (Note 2)	N/A	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A	N/A
	N_{oc3}	dBm/15kHz	-93 (Note 4)	N/A	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.1.4.1C-2	12	10
BW _{Channel}		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (No	ABS pattern (Note 5)		N/A	11000000 11000000 11000000 11000000 11000000	11000000 11000000 11000000 11000000 11000000
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000 1000000	N/A	N/A
CSI Subframe Sets	C _{CSI,0}		11000000 11000000 11000000 11000000 11000000	N/A	N/A
(Note7)	Ccsi,1		00111111 00111111 00111111 00111111 00111111	N/A	N/A
Number of control symbols	OFDM		2	Note 8	Note 8
PDSCH transmissio	n mode		6	Note 9	Note 9
Precoding granul	arity	PRB	50	N/A	N/A
PMI delay (Note		ms	8	N/A	N/A
Reporting inter		ms	1	N/A	N/A
Peporting mod			PUSCH 3-1	N/A	N/A
CodeBookSubsetRestriction bitmap			1111	N/A	N/A
Cyclic prefix			Normal	Normal	Normal

Test

Number

Note 5:

Reference

Channel

OCNG Pattern

Cell 2

Cell 3

Reference Value

SNR

Fraction of

UE

Cate

gory

Note 1:	$P_B = 1$.
Note 2:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 4:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 5:	ABS pattern as defined in [9].
Note 6:	Time-domain measurement resource restriction pattern for PCell measurements as defined in
	[7]
Note 7:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 9:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying
Note 10:	OCNG pattern as defined in Annex A.5. If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI
Note 10.	estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at
	the eNB downlink before SF#(n+4).
Note 11:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
	SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.1.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)- Non-MBSFN ABS

Propagation

Conditions (Note1)

Cell 2

Cell 3

Cell 1

Correlation

Matrix and

Antenna

								on (Note 2)	Throughput (%) Note 5	(0B) (Note 3)		
1	R.11 FDD	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 High	70	6.1	≥2	
	Note 4	FDD	FDD	FDD								
Note 1:	The propagat	he propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.										
Note 2:	The correlation	on matrix	and ante	nna conf	iguration	apply for	Cell 1, C	cell 2 and Cell 3.				
Note 3:	SNR correspo	NR corresponds to \hat{E}_s/N_{oc2} of cell 1.										
Note 4:	transmitted in	1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are smitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell the subframe is available in the definition of the reference channel.										

8.2.1.4.1D Enhanced Performance Requirement Type B - Single-layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The maximum Throughput is calculated from the total Payload in 9 subframes, averaged over 40ms.

The requirements are specified in Table 8.2.1.4.1D-2, with the addition of the parameters in Table 8.2.1.4.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 4 interference model defined in clause B.6.3. In Table 8.2.1.4.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.1.4.1D-1: Test Parameters for Single-layer Spatial Multiplexing (FRC) with TM4 interference model

Parame	eter	Unit	Cell 1	Ce	ell 2	Ce	II 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-	-3	-	3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-	-3	-	3
	σ	dB	0	0		0	
Cell-specific referen	ce signals		Antenna ports 0,1	Antenna	ports 0,1	Antenna	ports 0,1
N _{oc} at antenna port dBm/15 kHz -98							
Test number (Note 4	1)			Test 1	Test 2	Test 1	Test 2
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.28	3.34	0.74
Cell Id				6	1	1	6
CFI indicated in PCFICH				3	Random from set {1,2,3}	3	Random from set {1,2,3}
BW _{Channel}		MHz	10	10		1	0
Cyclic Prefix			Normal	No	rmal	No	rmal
Number of control O	FDM symbols		3		3	3	
PDSCH transmission	n mode		4		4		4
Interference model			N/A		ed in clause 6.3		ed in clause 6.3
Precoding			Random wideband precoding per TTI	As specified in clause B.6.3			
Time offset to cell 1		us	N/A		2	;	3
Frequency offset to cell 1		Hz	N/A		00		00
MBSFN			Not configured		nfigured		nfigured
NeighCellsInfo-	p-aList-r12		N/A	{dB-6, dB-3, dB0}		{dB-6, dl	B-3, dB0}
r12 (Note 3)	transmissionM odeList-r12		N/A	{2,3,	4,8,9}	{2,3,	4,8,9}

Note 1: $P_B = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells. Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Note 4: Test 1 and Test 2 are defined in Table 8.2.1.4.1D-2.

Table 8.2.1.4.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, Single-layer Spatial Multiplexing (FRC) with TM4 interference model

Test Num	Referenc e	ОС	NG Patt	ern		Propagation Condition		Correlation Matrix and	Reference Value		UE Categor
	Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughp ut (%)	SNR (dB) (Note 2)	у
1	R.11-10 FDD	OP.1 FDD	N/A	N/A	EVA 5	EVA 5	EVA 5	2x2 Low	85	17.0	≥1
2	R.11-9 FDD	OP.1 FDD	N/A	N/A	EPA 5	EPA 5	EPA 5	2x2 Low	85	10.1	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.2.1.4.1E Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports with CRS assistance information

The requirements are specified in Table 8.2.1.4.1E-2, with the addition of parameters in Table 8.2.1.4.1E-1. The purpose is to verify the closed loop rank-one performance with wideband precoding when CRS assistance information [7] is configured. In Table 8.2.1.4.1E-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.1.4.1E-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Param	Parameter		Cell 1	Cell 2	Cell 3	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)	
	σ	dB	0	0	0	
N_{oc} at antenna po	ort	dBm/15kHz	-98	N/A	N/A	
Ê _s /N _{oc}		dB	Reference Value in Table 8.2.1.4.1E-2	10.45	4.6	
BW _{Channel}		MHz	10	10	10	
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time Offset to Cel	II 1	μs	N/A	3	-1	
Frequency shift to	Cell 1	Hz	N/A	300	-100	
Cell Id			0	1	128	
Cell-specific refere	ence signals		Ante	enna ports 0,1		
Number of control symbols	OFDM		2	2	2	
PDSCH transmiss	ion mode		4	N/A	N/A	
Precoding granula		PRB	50	N/A	N/A	
PMI delay (Note 2		ms	8	N/A	N/A	
Reporting interval		ms	1	N/A	N/A	
Peporting mode			PUSCH 3-1	N/A	N/A	
CodeBookSubsetl bitmap	Restriction		001111	N/A	N/A	
Cyclic prefix			Normal	Normal	Normal	
Interference mode			N/A	As specified in clause B.5.3	As specified in clause B.5.3	
Probability of occurrence of transmission in interference cells		%	N/A	20	20	
Probability of occurrence of transmission		%	N/A	80	80	
rank in interfering cells	Rank 2	%	N/A	20	20	

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.1E-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)

Test Number	Reference Channel	OC	NG Patt	ern		ropagati		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory

1	R.10-3 FDD	OP.1 FDD	N/A	N/A	EVA5	EVA5	EVA5	2x2 low	70	10.8	≥2
Note 1:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.										
Note 2:	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.										
Note 3:	SNR correspo	SNR corresponds to $\hat{\mathbf{E}}_{s}/N_{eq}$ of cell 1.									

8.2.1.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.1.4.2-2,with the addition of the parameters in Table 8.2.1.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Table 8.2.1.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter	•	Unit	Test 1-2	Test 2A	Test 3
Daniel alemania	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
unocation —	σ	dB	0	0	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98	-98	-98
Precoding granu	ularity	PRB	50	25	6
PMI delay (Not	e 2)	ms	8	8	8
Reporting inte	rval	ms	1	1	1
Reporting mo	de		PUSCH 3-1	PUSCH 3-1	PUSCH 1-2
CodeBookSubsetRo bitmap	estriction		110000	110000	110000
PDSCH transmission mode			4	4	4
Number of OFDM symbols for PDCCH per component carrier		OFDM symbol	2	3	1

Note 1: $P_R = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE	UE DL
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category	category
1	10 MHz	R.35 FDD	OP.1 FDD	EPA5	2x2 Low	70	18.9	≥2	≥6
2	10 MHz	R.11 FDD	OP.1 FDD	ETU70	2x2 Low	70	14.3	≥2	≥6
2A (Note 1)	5 MHz	R.11-2 FDD	OP.1 FDD	ETU70	2x2 Low	70	14.0	≥2	≥6
3	10MHz 256QAM	R. 65 FDD	OP.1 FDD	EVA5	2x2 Low	70	25.3	11-12	≥11
Note 1:									

8.2.1.4.2A Enhanced Performance Requirement Type C – Multi-layer Spatial Multiplexing 2Tx Antenna Ports

The requirements are specified in Table 8.2.1.4.2A-2, with the addition of the parameters in Table 8.2.1.4.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband precoding.

Table 8.2.1.4.2A-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
N_{oc} at antenna port		dBm/15kHz	-98
Precoding granu	larity	PRB	50
PMI delay (Not	e 2)	ms	8
Reporting inte	rval	ms	1
Reporting mo	de		PUSCH 3-1
CodeBookSubsetRe	estriction		110000
bitmap			
PDSCH transmission	on mode		4

Note 1: $P_R = 1$.

Note 2: If the UE reports in an available uplink reporting instance

at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.2.1.4.2A-2: Enhanced Performance Requirement Type C for Multi-Layer Spatial Multiplexing with TM4 (FRC)

	Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
	number	width	Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Category
						Antenna	Maximum	(dB)	
						Configuration	Throughput		
							(%)		
ĺ	1	10 MHz	R.11 FDD	OP.1 FDD	ETU70	2x2 Medium	70	18.3	≥2

8.2.1.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier, the requirements are specified in Table 8.2.1.4.3-2, with the addition of the parameters in Table 8.2.1.4.3-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.1.4.3-4, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.1.4.3-6, based on single carrier requirement specified in Table 8.2.1.4.3-5, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with4 DL CCs, the requirements are specified in Table 8.2.1.4.3-7, based on single carrier requirement specified in Table 8.2.1.4.3-5, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 5 DL CCs, the requirements are specified in Table 8.2.1.4.3-8, based on single carrier requirement specified in Table 8.2.1.4.3-5, with the addition of the parameters in Table 8.2.1.4.3-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.1.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	N_{oc} at antenna port		-98
Precoding granu	ılarity	PRB	6
PMI delay (Not	e 2)	ms	8
Reporting inte	rval	ms	1
Reporting mo	de		PUSCH 1-2
CodeBookSubsetRo	estriction		000000000000000000000000000000000000000
bitmap			000011111111111111111100000000
			00000000
PDSCH transmission	on mode		4

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Void. Note 4: Void. Note 5: Void.

Table 8.2.1.4.3-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

					Propa- Correlation		Reference value	
Test num.	Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	10 MHz	R.36 FDD	OP.1 FDD	EPA5	4x2 Low	70	14.7	≥2
Note 1	: Void.							

Table 8.2.1.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Parameter		Unit	Value
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granularity		PRB	4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs
PMI delay (Not	e 2)	ms	8
Reporting inte	rval	ms	1
Reporting mo	de		PUSCH 1-2
CodeBookSubsetRestriction bitmap			00000000000000000000000000000000000000
CSI request field (Note 3)		'10'
PDSCH transmission	on mode		4

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported

PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Multiple CC-s under test are configured as the 1st set of serving cells by higher

layers.

Note 4: ACK/NACK bits are transmitted using PUSCH with PUCCH format 1b with channel selection configured for Tests in Table 8.2.1.4.3-4, and with PUCCH

format 3 for Tests in Table 8.2.1.4.3-6.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.1.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA with 2DL CCs

				Propa-	Correlation	Reference	e value	
Test num	Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory
1	2x10 MHz	R.14 FDD	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	10.8	≥3
2	2x20 MHz	R.14-3 FDD	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	10.9	≥5
3	2x5 MHz	R.14-6 FDD	OP.1 FDD (Note 1)	EVA5 4x2 Low	70	9.5	≥2	
3	ZAJ IVII IZ	N.14-01 DD	OP.1 FDD (Note 1)		4XZ LOW	70	9.5	-2
4	10MHz+5	R.14 FDD for 10MHz CC	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	10.1	≥3
4	MHz	R.14-6 FDD for 5MHz CC	OP.1 FDD (Note 1)	EVAS	4X2 LOW	70	9.5	ล
5	15MHz+5	R.14-7 FDD for 15MHz CC	OP.1 FDD (Note 1)	EVA5	4x2 Low	70	10.1	≥3
5	MHz	R.14-6 FDD for 5MHz CC	OP.1 FDD (Note 1)	EVAS	4x2 LOW	70	9.5	23

NOTE 1: The OCNG pattern applies for each CC.

NOTE 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.1.4.3-5: Single carrier performance for multiple CA configurations

		_ Correlation		Correlation	Reference	value	
Band- width	Reference channel	OCNG pattern	Propa- gation condi-tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	
1.4MHz	R.14-4 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.4	
3MHz	R.14-5 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5	
5MHz	R.14-6 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5	
10 MHz	R.14 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1	
15MHz	R.14-7 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1	
20MHz	R.14-3 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.3	

Table 8.2.1.4.3-6: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

Test num.	CA Band-width combination	Requirement	UE category					
1	3x20MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
2	20MHz+20MHz+15MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
3	20MHz+20MHz+10MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
4	20MHz+15MHz+15MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
5	20MHz+15MHz+10MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
6	20MHz+10MHz+10MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
7	15MHz+15MHz+10MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
8	20MHz+10MHz+5MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
9	20MHz+15MHz+5MHz	As specified in Table 8.2.1.4.3-5 per CC	≥5					
10	10MHz+10MHz+5MHz	As specified in Table 8.2.1. 4.3-5 per CC	≥5					
	Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3							

Table 8.2.1.4.3-7: Minimum performance (FRC) based on single carrier performance for CA with 4 DL

Test num.	CA Band-width combination	Requirement	UE category					
1	4x20MHz	As specified in Table 8.2.1.4.3-5 per CC	≥8					
2	10MHz+20MHz+20MHz+20MHz	As specified in Table 8.2.1. 4.3-5 per CC	≥8					
3	10MHz+10MHz+20MHz+20MHz	As specified in Table 8.2.1. 4.3-5 per CC	≥8					
4	5MHz+10MHz+20MHz+20MHz	As specified in Table 8.2.1. 4.3-5 per CC	≥8					
5	5MHz+10MHz+10MHz+20MHz	As specified in Table 8.2.1. 4.3-5 per CC	≥8					
NOTE 1: T	NOTE 1: The applicability of requirements for different CA configurations and bandwidth combination							
S	ets is defined in 8.1.2.3							

Table 8.2.1.4.3-8: Minimum performance (FRC) based on single carrier performance for CA with 5 DL CCs

Test num.	CA Band-width combination	Requirement	UE category
1	5x20MHz	As specified in Table 8.2.1.4.3-5 per CC	8, ≥11
	ne applicability of requirements for difefined in 8.1.2.3	ferent CA configurations and bandwidth combi	ination sets is

8.2.1.4.3A Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port for dual connectivity

For dual connectivity the requirements are specified in Table 8.2.1.4.3A-3 for 2DL CCs and Table 8.2.1.4.3A-4 for 3DL CCs, based on single carrier requirement specified in Table 8.2.1.4.3A-2, with the addition of the parameters in Table 8.2.1.4.3A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding by using dual connectivity transmission.

Table 8.2.1.4.3A-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

Parameter		Unit	Values
Downlink novem	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
N_{oc} at antenna	port	dBm/15kHz	-98
Precoding granu	ularity	PRB	6 for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, and 8 for 15MHz CCs and 20MHz CCs
PMI delay (Not	te 2)	ms	8
Reporting inte	rval	ms	1
Reporting mo	de		PUSCH 1-2
CodeBookSubsetR bitmap	estriction		00000000000000000000000000000000000000
PDSCH transmissi	on mode		4
ACK/NACK transi	mission		Separate ACK/NACK feedbacks with PUCCH format 1b on the MCG and SCG
CSI feedbad	k		Separate PUSCH feedbacks on the MCG and SCG
Time offset between MCG CC and SCG CC		μѕ	0 for UE under test supporting synchronous dual connectivity; 334 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 4)
Note 1. D 1			·

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Note 4: As defined in TS36.300 [11].

Note 5: If the UE supports both SCG bearer and Split bearer, the SCG bearer is configured.

Table 8.2.1.4.3A-2: Single carrier performance for multiple dual connectivity configurations

			Propa-	Correlation	Reference value		
Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	
1.4MHz	R.14-4 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.36	
3MHz	R.14-5 FDD	OP. 1 FDD	EVA5	4x2 Low	70	9.5	
5MHz	R.14-6 FDD	OP. 1 FDD	EVA5	4x2 Low	70	9.5	
10 MHz	R.14 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.1	
15MHz	R.14-7 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.1	
20MHz	R.14-3 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.3	

Table 8.2.1.4.3A-3: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity with 2 DL CCs

Test num.	Band-width combination	Requirement	UE category
1	2x20 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5
2	15+20 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5
3	10+20MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5
4	2x15 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5
5	2x10 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥3
6	15+5 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥3
7	10+15 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different dual connectvity configurations and bandwidth combination sets is defined in 8.1.2.3A.

Table 8.2.1.4.3A-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity with 3DL CCs

Test num.	Band-width combination	Requirement	UE category				
1	20+20+15MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5				
2	20+15+15MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5				
3	3x20 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5				
4	20+20+10 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5				
5	20+15+10 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5				
6	20+10+10 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5				
7	15+15+10 MHz	As specified in Table 8.2.1.4.3A-2 per CC	≥5				
	Note 1: The OCNG pattern applies for each CC.						
Note 2: The	· · · · · · · · · · · · · · · · · · ·						
comb	pination sets is defined in 8.1.2	.3A.					

8.2.1.5 MU-MIMO

8.2.1.6 [Control channel performance: D-BCH and PCH]

8.2.1.7 Carrier aggregation with power imbalance

For CA, the requirements in this section verify the ability of an intraband adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only.

8.2.1.7.1 Minimum Requirement

The requirements are specified in Table 8.2.1.7.1-2, with the addition of the parameters in Table 8.2.1.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.1.7.1-1: Test Parameters for CA

Paramete	r	Unit	Test 1	Test 2-3
Davinlink navyar	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)
	σ	dB	0	0
$N_{\it oc}$ at antenna poi	t	dBm/15kHz	Off (Note 2)	Off (Note 2)
Symbols for unused	l PRBs		OCNG (Note 3)	OCNG (Note 3)
Modulation			64 QAM	64 QAM
Maximum number of transmission	of HARQ		1	1
Redundancy versio sequence	n coding		{0}	{0}
PDSCH transmission of PCell	on mode		1	3
PDSCH tramsmissi of SCell	on mode		3	1
OCNG Pattern	PCell		OP.1 FDD	OP.5 FDD
OCING Fallern	SCell		OP.5 FDD	OP.1 FDD
Propagation PCe			Clause B.1	Clause B.1
Conditions SCell			Clause B.1	Clause B.1
Correlation Matrix	PCell		1x2	2x2
and Antenna	SCell		2x2	1x2

Note 1: $P_B = 0$ for 1x2 and $P_B = 1$ for 2x2 antenna configuration.

Note 2: No external noise sources are applied

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data

transmitted over the OCNG PDSCHs shall be uncorrelated.

pseudo random data.

Note 4: Void

Table 8.2.1.7.1-2: Minimum performance (FRC) for CA

Test Number			Referenc	e channel	port (dBm/15KHz)		715KHz) Fraction of Maximum Throughput (%)		UE Category
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for Scell	PCell	SCell	
1	20	20	R.49 FDD	NA	-85	-79	85	NA	≥5
2	10	10	NA	R.49-1 FDD	-79	-85.8	NA	85	≥5
3	5	5	NA	R.49-2 FDD	-79	-85.9	NA	85	≥5

Note 1: The OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill the control channel and PDSCH.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

8.2.1.8 Intra-band non-contiguous carrier aggregation with timing offset

The requirements in this section verify the ability of an intraband non-contiguous carrier aggregation UE to demodulate the signal transmitted by the PCell and SCell in the presence of timing offset between the cells. Throughput is measured on both cells.

8.2.1.8.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.1.8.1-2, with the addition of the parameters in Table 8.2.1.8.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.1.8.1-1: Test Parameters for CA

Paramete	r	Unit	Test 1
Develiels resume	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	a port	dBm/15kHz	-98
Modulatio	n		64 QAM
Maximum number	of HARQ		4
transmissio	on		
Redundancy version	on coding		{0,0,1,2}
sequence)		
PDSCH transmiss	ion mode		3
of PCell			
PDSCH tramsmiss	ion mode		3
of SCell			
Note 1: $P_B = 1$.			
Note 2: The OCI	used control		

Note 2: The OCNG pattern is used to fill unused control

channel and PDSCH.

Table 8.2.1.8.1-2: Minimum performance (FRC) for CA

Test	Cell	Band-	Referenc	OCNG	Propagati	Correlati	Refence va	alue	Timing	UE	l
Numbe r		width	e Channel	Patter n	on Condition s	on Matrix and Antenna	Fraction of Maximum Throughput (%)	SNR (dB)	relative to PCell (µs)	Catego ry	
1	PCell	10MH z	R.35-4 FDD	OP.1	EPA200	2x2 Low	70	21.15	N/A	≥3	
1	SCell	10MH z	R.35-3 FDD	FDD	EPA200	2x2 Low	60	15.18	-30.26	23	

Note 1: The EPA200 propagation channels applied to PCell and SCell are statistically independent.

Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are defined in 8.1.2.3.

8.2.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.2.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.2.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value						
Uplink downlink configuration (Note 1)		1						
Special subframe configuration (Note 2)		4						
Cyclic prefix		Normal						
Cell ID		0						
Inter-TTI Distance		1						
Number of HARQ processes per component carrier	Processes	7						
Maximum number of HARQ transmission		4						
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM						
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths unless otherwise stated						
Cross carrier scheduling		Not configured						

8.2.2.1 Single-antenna port performance

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.4 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS. The QPSK and 64QAM cases are also used to verify the performance for all bandwidths specified in Table 5.6.1-1.

8.2.2.1.1 Minimum Requirement

For single carrier, the requirements are specified in Table 8.2.2.1.1-2, with the addition of the parameters in Table 8.2.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.2.1.1-4, with the addition of the parameters in Table 8.2.2.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.1.1-7, based on single carrier requirement specified in Table 8.2.2.1.1-5, with the addition of the parameters in Table 8.2.2.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 4 DL CCs, the requirements are specified in Table 8.2.2.1.1-8, based on single carrier requirement specified in Table 8.2.2.1.1-5, with the addition of the parameters in Table 8.2.2.1.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.1.1-1: Test Parameters

Parameter		Unit	Test 1- 5	Test 6-8	Test 9- 15	Test 16- 18	Test 19
Downlink $ ho_{\!\scriptscriptstyle A}$		dB	0	0	0	0	0
power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)				
a	σ	dB	0	0	0	0	0
N_{oc} at antenna	a port	dBm/15kHz	-98	-98	-98	-98	-98
Symbols for un PRBs	used		OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)
Modulation	ı		QPSK	16QAM	64QAM	16QAM	QPSK
ACK/NACK fee	dback		Multiplexing	Multiplexin	Multiplexin	Multiplexin	Multiplexing
mode				g	g	g	
PDSCH transmission mode			1	1	1	1	1

Note 1: $P_B = 0$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 3: Void Note 4: Void

Table 8.2.2.1.1-2: Minimum performance (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2	≥1
2	10 MHz	R.2 TDD	OP.1 TDD	ETU70	1x2 Low	70	-0.6	≥1
3	10 MHz	R.2 TDD	OP.1 TDD	ETU300	1x2 Low	70	-0.2	≥1
4	10 MHz	R.2 TDD	OP.1 TDD	HST	1x2	70	-2.6	≥1
5	1.4 MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	0.0	≥1
6	10 MHz	R.3 TDD	OP.1 TDD	EVA5	1x2 Low	70	6.7	≥2
	5 MHz	R.3-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	6.7	1
7	10 MHz	R.3 TDD	OP.1 TDD	ETU70	1x2 Low	30	1.4	≥2
	5 MHz	R.3-1 TDD	OP.1 TDD	ETU70	1x2 Low	30	1.4	1
8	10 MHz	R.3 TDD	OP.1 TDD	ETU300	1x2 High	70	9.3	≥2
	5 MHz	R.3-1 TDD	OP.1 TDD	ETU300	1x2 High	70	9.3	1
9	3 MHz	R.5 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	≥1
10	5 MHz	R.6 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	≥2
	5 MHz	R.6-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	1
11	10 MHz	R.7 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	≥2
	10 MHz	R.7-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.6	1
12	10 MHz	R.7 TDD	OP.1 TDD	ETU70	1x2 Low	70	19.1	≥2
	10 MHz	R.7-1 TDD	OP.1 TDD	ETU70	1x2 Low	70	19.1	1
13	10 MHz	R.7 TDD	OP.1 TDD	EVA5	1x2 High	70	19.1	≥2
	10 MHz	R.7-1 TDD	OP.1 TDD	EVA5	1x2 High	70	19.1	1
14	15 MHz	R.8 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.8	≥2
	15 MHz	R.8-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.8	1
15	20 MHz	R.9 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	≥3
	20 MHz	R.9-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	2
	20 MHz	R.9-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	17.7	1
16	3 MHz	R.0 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.1	≥1
17	10 MHz	R.1 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.0	≥1
18	20 MHz	R.1 TDD	OP.1 TDD	ETU70	1x2 Low	30	2.1	≥1
19	10 MHz	R.41 TDD	OP.1 TDD	EVA5	1x2 Low	70	-5.3	≥1
Note 1:	Void.	•	-	•		•	•	•

Table 8.2.2.1.1-3: Test Parameters for CA

	Parameter	Unit	Value
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	0
Λ	I_{oc} at antenna port	dBm/15kHz	-98
Symb	ools for unused PRBs		OCNG (Note 2)
	Modulation		QPSK
ACK/NACK feedback mode			PUCCH format 1b with channel selection for Tests in Table 8.2.2.1.1-4; PUCCH format 3 for Tests in Table 8.2.2.1.1-7
PDSC	CH transmission mode		1
_	•		

Note 1: $P_B = \overline{0}$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one

PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated

pseudo random data, which is QPSK modulated.

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.2.1.1-4: Minimum performance (FRC) for CA with 2DL CCs

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	2x20MHz	R.42 TDD	OP.1 TDD (Note 1)	EVA5	1x2 Low	70	-1.2	≥5
2	20MHz+ 15MHz	R.42 TDD for 20MHz CC	OP.1 TDD (Note 1)	EVA5	1x2 Low	70	-1.4	≥5
		R.42-3 TDD for 15MHz CC	OP.1 TDD (Note 1)			70	-1.4	

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in

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Note 3: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be

assigned on any CC.

Table 8.2.2.1.1-5: Single carrier performance for multiple CA configurations

	_ Correlation		Correlation	Reference	value	
Band- width	Reference channel	OCNG pattern	Propa- gation condi-tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.6
3MHz	R.42-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.8
5MHz	R.42-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2
10MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.6
15MHz	R.42-3 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4
20MHz	R.42 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4

Table 8.2.2.1.1-6: Void

Table 8.2.2.1.1-7: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

Test num.		CA Band-width combination	Requirement	UE category			
1		3x20MHz	As specified in Table 8.2.2.1.1-5 per CC	≥5			
2	2 20MHz+20MHz+15MHz		As specified in Table 8.2.2.1.1-5 per CC	≥5			
Note 1:							
Note 2:		sec timing difference between PCell and igned on any CC.	any SCell is applied in inter-band CA case, whe	re PCell can be			

Table 8.2.2.1.1-8: Minimum performance (FRC) based on single carrier performance for CA with 4 DL

Test num.	CA Band-width combination	Requirement	UE category
1	4x20MHz	As specified in Table 8.2.2.1.1-5 per CC	≥8
2	20MHz+20MHz+20MHz+15MHz	As specified in Table 8.2.2.1.1-5 per CC	≥8
	he applicability of requirements for different .1.2.3	CA configurations and bandwidth combination s	ets is defined in

8.2.2.1.2 Void

8.2.2.1.3 Void

8.2.2.1.4 Minimum Requirement 1 PRB allocation in presence of MBSFN

The requirements are specified in Table 8.2.2.1.4-2, with the addition of the parameters in Table 8.2.2.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the single-antenna performance with a single PRB allocated at the lower band edge in presence of MBSFN.

Table 8.2.2.1.4-1: Test Parameters for Testing 1 PRB allocation

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	0
N_{oc} at antenna	port	dBm/15kHz	-98
Symbols for MBSFN MBSFN subframes			OCNG (Note 3)
ACK/NACK feedba	ck mode		Multiplexing
PDSCH transmission	on mode		1
р 0		•	•

Note 1: $P_B = 0$

Note 2: The MBSFN portion of an MBSFN subframe comprises the whole MBSFN subframe except the first two symbols in the

Note 3: The MBSFN portion of the MBSFN subframes shall contain QPSK modulated data. Cell-specific reference signals are not inserted in the MBSFN portion of the MBSFN subframes, QPSK modulated MBSFN data is used instead.

Table 8.2.2.1.4-2: Minimum performance 1PRB (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and	Fraction of	SNR	Category
					Antenna	Maximum	(dB)	
					Configuration	Throughput		
						(%)		
1	10 MHz	R.29 TDD	OP.3 TDD	ETU70	1x2 Low	30	2.0	≥1

8.2.2.2 Transmit diversity performance

8.2.2.2.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.1-2, with the addition of the parameters in Table 8.2.2.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.2.2.2.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
	σ	dB	0			
N_{oc} at antenna	port	dBm/15kHz	-98			
ACK/NACK feedba	ck mode		Multiplexing			
PDSCH transmission	on mode		2			
Note 1: $P_B = 1$						

Table 8.2.2.2.1-2: Minimum performance Transmit Diversity (FRC)

Test	Bandw	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	idth	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.11 TDD	OP.1 TDD	EVA5	2x2 Medium	70	6.8	≥2
ľ	5 MHz	R.11-2 TDD	OP.1 TDD	EVA5	2x2 Medium	70	6.8	1
2	10 MHz	R.10 TDD	OP.1 TDD	HST	2x2	70	-2.3	≥1

8.2.2.2. Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.2.2-2, with the addition of the parameters in Table 8.2.2.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC-FSTD) with 4 transmitter antennas.

Table 8.2.2.2.1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
	σ	dB	0			
N_{oc} at antenna	port	dBm/15kHz	-98			
ACK/NACK feedba	ck mode		Multiplexing			
PDSCH transmission	on mode		2			
Note 1: $P_B = 1$						

Table 8.2.2.2.2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	1.4 MHz	R.12 TDD	OP.1 TDD	EPA5	4x2 Medium	70	0.2	≥1
2	10 MHz	R.13 TDD	OP.1 TDD	ETU70	4x2 Low	70	-0.5	≥1

8.2.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

The requirements are specified in Table 8.2.2.2.3-2, with the addition of parameters in Table 8.2.2.2.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Table 8.2.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.2.2.3-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2
Uplink downlink conf	iguration		1	1
Special subframe con	figuration		4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A
\widehat{E}_s/N_{oc2}	\widehat{E}_s/N_{oc2}		Reference Value in Table 8.2.2.2.3-2	6
BW _{Channel}		MHz	10	10
Subframe Configu	ıration		Non-MBSFN	Non-MBSFN
Time Offset between	n Cells	μs	2.5 (synch	ronous cells)
Cell Id			0	1
ABS pattern (No	te 5)		N/A	0000010001 0000000001
RLM/RRM Measuremer Pattern (Note			0000000001 0000000001	N/A
CSI Subframe Sets	C _{CSI,0}		0000010001 0000000001	N/A
(Note 7)	C _{CSI,1}		1100101000 1100111000	N/A
Number of control OFDM symbols			2	2
ACK/NACK feedbac	k mode		Multiplexing	N/A
PDSCH transmission			2	N/A
Cyclic prefix			Normal	Normal

Note 1: $P_B = 1$

Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.

Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.

Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.

Note 5: ABS pattern as defined in [9].

Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].

Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].

Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.

Note 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.2.2.3-2: Minimum Performance Transmit Diversity (FRC)

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 2)	
1	R.11-4 TDD Note 4	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Medium	70	3.8	≥2

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel. Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

8.2.2.2.3A Minimum Requirement 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.2.3A-2, with the addition of parameters in Table 8.2.2.2.3A-1. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.2.3A-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.2.3A-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Cell 1	Cell 2	Cell 3	
Uplink downlink confi	guration		1	1	1	
Special subframe con	figuration		4	4	4	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)	
	σ	dB	0	N/A	N/A	
	N_{oc1}	dBm/15kHz	-98 (Note 2)	N/A	N/A	
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A	N/A	
	N_{oc3}	dBm/15kHz	-93 (Note 4)	N/A	N/A	
\widehat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.2.2.3A-2	12	10	
BW _{Channel}		MHz	10	10	10	
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time Offset betwee	n Cells	μs	N/A	3	-1	
Frequency shift between	en Cells	Hz	N/A	300	-100	
Cell Id			0	126	1	
ABS pattern (Not	e 5)		N/A	0000000001 0000000001	0000000001 0000000001	
RLM/RRM Measur Subframe Pattern (I			0000000001 0000000001	N/A	N/A	
CSI Subframe Sets	Ccsi,0		000000001 000000001	N/A	N/A	
(Note7)	C _{CSI,1}		1100111000 1100111000	N/A	N/A	
Number of control OFDM symbols			2	Note 8	Note 8	
ACK/NACK feedbac	k mode		Multiplexing	N/A	N/A	
PDSCH transmissio	n mode		2	Note 9	Note 9	
Cyclic prefix			Normal	Normal	Normal	

- Note 1: $P_{p} = 1$.
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 5: ABS pattern as defined in [9].
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
- Note 10: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
- Note 11: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.2.2.3A-2: Minimum Performance Transmit Diversity (FRC)

Test Number	Reference Channel	OCNG Pattern			Propagation Conditions (Note 1)			Correlation Matrix and	Reference Value		UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 3)	gory	
1	R.11-4 TDD Note 4	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Medium	70	3.5	≥2	
Note 1:	Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.											

- Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3...
- Note 3: SNR corresponds to \hat{E}_s/N_{ac2} of cell 1.
- Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are Note 4: transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms. Note 5:

8.2.2.2.4 Enhanced Performance Requirement Type A – 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.2.2.2.4-2, with the addition of parameters in Table 8.2.2.2.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.2.2.2.4-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.2.4-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

Parameter		Unit	Cell 1	Cell 2	Cell 3	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3	
	σ	dB	0	0	0	
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
$N_{\it oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A	
DIP (Note 2)		dB	dB N/A -1.73		-8.66	
BWchannel		MHz	10	10	10	
Cyclic Prefix			Normal	Normal	Normal	
Cell Id		0	1	2		
Number of control OFDM	symbols		2	2	2	
PDSCH transmission			2	N/A	N/A	
Interference mode	el		N/A	As specified in clause B.5.2	As specified in clause B.5.2	
Probability of occurrence of	Rank 1	%	N/A	80	80	
transmission rank in interfering cells	Rank 2	%	N/A	20	20	
Reporting interva	ms	5	N/A	N/A		
Reporting mode			PUCCH 1-0	N/A	N/A	
ACK/NACK feedback	mode		Multiplexing	N/A	N/A	
Physical channel for CQI		PUSCH(Note 5)	N/A	N/A		
cqi-pmi-Configuration	Index		4	N/A	N/A	

Note 1: $P_B = 1$

Note 2: The respective received power spectral density of each interfering cell relative to N_{oc} is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 4: All cells are time-synchronous.

Note 5: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Table 8.2.2.2.4-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

Test Number	Reference Channel	OCNG Pattern			Propagation Conditions			Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.46 TDD	OP. 1 TD D	N/A	N/A	EV A70	EV A70	EV A70	2x2 Low	70	-1.4	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.2.2.2.5 Minimum Requirement 2 Tx Antenna Port (when *EIMTA-MainConfigServCell-r12* is configured)

The requirements are specified in Table 8.2.2.2.5-2 with the addition of the parameters in Table 8.2.2.2.5-1 and the downlink physical channel setup according to Annex C.3.2. The test purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas in case of using eIMTA TDD UL-DL reconfiguration for TDD serving cell(s) via monitoring PDCCH with eIMTA-RNTI on a PCell.

Table 8.2.2.2.5-1: Test Parameters for Transmit diversity Performance (FRC) when EIMTA-MainConfigServCell-r12 is configured

Parameter	_	Unit	Value
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
N_{oc} at antenna port		dBm/15kHz	-98
Uplink downlink configuration in SIB1	(Note 2)		0
Downlink HARQ reference configurate HarqReferenceConfig-r12) (Note 2)	ion (eimta-		5
Set of dynamic TDD UL-DL configura 2,3)	ations (NOTES		{0, 1, 2, 3, 4, 5, 6}
Periodicity of monitoring the L1 recor (eimta-CommandPeriodicity-r12)	figuration DCI	ms	10
Set of subframes to monitor the L1 re (eimta-CommandSubframeSet-r12) ({0,1,5,6}
Number of DL HARQ processes		Processes	15
PDSCH transmission mode			2
ACK/NACK feedback mode (Note 5)			Multiplexing

Note 1: $P_{p} = 1$

Note 2: As specified in Table 4.2-2 in TS 36.211.

Note 3: UL/DL configuration in PDCCH with elMTA-RNTI is randomly selected from the given set on a per-DCI basis with equal probability.

Note 4: The set of subframes to monitor PDCCH with eIMTA-RNTI for frame n includes subframes {1,5,6} in frame n-1 and subframe 0 in frame n. Subframes for reconfiguration DCI transmission are chosen in a random way on a per-DCI basis with equal probability.

Note 5: PUCCH Format 3 is used for DL HARQ feedback.

Table 8.2.2.2.5-2: Minimum performance Transmit diversity when EIMTA-MainConfigServCell-r12 is configured

				Correlation	Reference v	alue	
Test	Reference channel	OCNG Pattern	Propagation Conditions	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	UE Category
1	R.67 TDD	OP.1 TDD	EVA5	2x2 Medium	70	5.0	≥1

8.2.2.2.6 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM2 interference model

The requirements are specified in Table 8.2.2.2.6-2, with the addition of parameters in Table 8.2.2.2.6-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 2 interference model defined in clause B.6.1. In Table 8.2.2.2.6-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.2.6-1: Test Parameters for Transmit Diversity Performance (FRC) with TM2 interference model

Parame	eter	Unit	Cell 1	Cell 2	Cell 3				
Uplink downlink Configu	uration		1	1	1				
Special subframe config	guration		4	4	4				
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3				
Downlink power allocati	on $ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3				
	σ	dB	0	0	0				
Cell-specific reference s	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1				
N_{oc} at antenna port		dBm/15kHz		-98					
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34				
BW _{Channel}		MHz	10	10	10				
Cyclic Prefix			Normal	Normal	Normal				
Cell Id			0	6	1				
Number of control OFD normal subframes	M symbols in		3	3	3				
CFI indicated in PCFICI subframes			3	3	3				
Number of control OFD special subframes	-		2	2	2				
CFI indicated in PCFIC subframes			2	2	2				
PDSCH transmission m	iode		2	2	2				
Interference model			N/A	As specified in clause B.6.1	As specified in clause B.6.1				
MBSFN			Not configured	Not configured	Not configured				
Time offset to cell 1		us	N/A	2	3				
Frequency offset to cell	1	Hz	N/A	200	300				
NeighCellsInfo- p-aList-r12 r12			N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}				
(Note 3) tra	nsmissionModeLis	st	N/A	{2,3,4,8,9}	{2,3,4,8,9}				
Note 1: $P_B = 1$ Note 2: Cell 1 is the serving cell. Cell 2. 3 are the interfering cells.									

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.2.2.2.6-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM2 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.11-12 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	15.3	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.2.2.2.7 Enhanced Performance Requirement Type B - 2 Tx Antenna Ports with TM9 interference model

The requirements are specified in Table 8.2.2.2.7-2, with the addition of parameters in Table 8.2.2.2.7-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In Table 8.2.2.2.7-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.2.7-1: Test Parameters for Transmit Diversity Performance (FRC) with TM9 interference model

Uplink downlink Configuration Special subframe configuration	า		1	4	
Special subframe configuration	า		ı ı	1	1
				4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	0	0
	σ	dB	0	-3	-3
Cell-specific reference signals			Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port		dBm/15kHz		-98	
\hat{E}_s/N_{oc}		dB	N/A	3.28	0.74
BWchannel		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Number of control OFDM syml normal subframes	bols in		3	3	3
CFI indicated in PCFICH in no	rmal		3	Random from	Random from
subframes				set {1,2,3}	set {1,2,3}
Number of control OFDM syml special subframes	bols in		2	2	2
CFI indicated in PCFICH in sp	ecial		2	Random from	Random from
subframes				set {1,2}	set {1,2}
PDSCH transmission mode			2	9	9
Interference model			N/A	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signals			N/A	Antenna ports 15,16	Antenna ports 15,16
CSI-RS periodicity and subfrar T _{CSI-RS} / Δ _{CSI-RS}	me offset	Subframes	N/A	10 / 4	10 / 4
CSI reference signal configura	tion		N/A	6	7
Zero-power CSI-RS configuration I _{CSI-RS} / ZeroPowerCSI-RS bitmap		Subframes / bitmap	N/A	9 / 010000000000 0000	9 / 001000000000 0000
Time offset to cell 1		us	N/A	5	-5
Frequency offset to cell 1		Hz	N/A	600	-600
MBSFN			Not configured	Not configured	Not configured
NeighCellsInfo- p-aList-r1		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}	
(Note 4) transmiss		N/A	{2,3,4,8,9}	{2,3,4,8,9}	

Note 1: $P_B = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.2.2.2.7-2: Minimum Performance for Enhanced Performance Requirement Type B, Transmit Diversity (FRC) with TM9 interference model

Test Number	Reference Channel	OCNG Pattern			Propagation Conditions		Correlation Matrix and	Reference Value				UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory	
1	R.11-11 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	8.1	≥1	

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.2.2.3 Open-loop spatial multiplexing performance

8.2.2.3.1 Minimum Requirement 2 Tx Antenna Port

For single carrier, the requirements are specified in Table 8.2.2.3.1-2, with the addition of the parameters in Table 8.2.2.3.1-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.2.3.1-4, with the addition of the parameters in Table 8.2.2.3.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.3.1-7, based on single carrier requirement specified in Table 8.2.2.3.1-5, with the addition of the parameters in Table 8.2.2.3.1-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 4 DL CCs, the requirements are specified in Table 8.2.2.3.1-8, based on single carrier requirement specified in Table 8.2.2.3.1-5, with the addition of the parameters in Table 8.2.2.3.1-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.3.1-1: Test Parameters for Large Delay CDD (FRC)

Parameter	i	Unit	Test 1-3
Davislink	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ck mode		Bundling
PDSCH transmission	on mode		3

Note 1: $P_B = 1$ Note 2: Void.

Note 3: Void.

Table 8.2.2.3.1-2: Minimum performance Large Delay CDD (FRC)

Test num ber	Bandwidth	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference v Fraction of Maximum Throughput (%)	/alue SNR (dB)	UE Cate gory
1 (Note 2)	10 MHz	R.11-1 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.1	≥2
2	10 MHz	R.35 TDD	OP.1 TDD	EVA200	2x2 Low	70	20.3	≥2
3	10 MHz	R.35-2 TDD	OP.1 TDD	ETU600	2x2 Low	70	21.1	≥2

Note 1: Void.

Note 2: For UE that supports CRS interference handling, the CRS assistance information defined in [7] is provided. The CRS assistance information includes two aggressor cells with 2 CRS ports and cell ID of agressor cells are 1 and 128. For UE that does not support CRS interference handling, CRS assistance information is not provided.

Table 8.2.2.3.1-3: Test Parameters for Large Delay CDD (FRC) for CA

Parameter		Unit	Value
Deventintenance	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ck mode		PUCCH format 1b with channel selection for Tests in Table 8.2.2.3.1-4; PUCCH format 3 for Tests in Table 8.2.2.3.1-7
PDSCH transmission	on mode		3

Note 1:

 $P_B = 1$

Note 2: Void

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.2.3.1-4: Minimum performance Large Delay CDD (FRC) for CA with 2DL CCs

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	tion Reference valu		UE
num ber		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categ ory
1	2x20 MHz	R.30-1 TDD	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	13.7	≥5
2	20MHz+15M Hz	R.30-1 TDD for 20MHz CC	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	13.0	≥5
		R.11-9 TDD for 15MHz CC	OP.1 TDD (Note 1)	EVA70		70	12.9	

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.2.3.1-5: Single carrier performance for multiple CA configurations

I				Propa-	Correlation	Reference value		
	Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum	SNR (dB)	

					throughput (%)	
1.4MHz	R.11-5 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.2
3MHz	R.11-6 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
5MHz	R.11-7 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.6
10 MHz	R.11-8 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
15MHz	R.11-9 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.9
20MHz	R.30-1 TDD	OP. 1 TDD	EVA70	2x2 Low	70	13.0

Table 8.2.2.3.1-6: Void

Table 8.2.2.3.1-7: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

Test num.	CA Band-width combination	Requirement	UE category					
1	3x20MHz	As specified in Table 8.2.2.3.1-5 per CC	≥5					
2	20MHz+20MHz+15MHz	As specified in Table 8.2.2.3.1-5 per CC	≥5					

Table 8.2.2.3.1-8: Minimum performance (FRC) based on single carrier performance for CA with 4 DL CCs

Test num. CA Band-width combination		Requirement	UE category
1	4x20MHz	As specified in Table 8.2.2.3.1-5 per CC	≥8
2	20MHz+20MHz+20MHz+15MHz	As specified in Table 8.2.2.3.1-5 per CC	≥8
	ne applicability of requirements for different 1.2.3	CA configurations and bandwidth combination s	ets is defined in

8.2.2.3.1A Soft buffer management test

For CA, the requirements are specified in Table 8.2.2.3.1A-2, with the addition of the parameters in Table 8.2.2.3.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify UE performance with proper instantaneous buffer implementation.

Table 8.2.2.3.1A-1: Test Parameters for soft buffer management test (FRC) for CA

Parameter		Unit	Test 1-2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ		0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedback mode			- (Note 2)
PDSCH transmission	on mode		3

Note 1: $P_{R} = 1$

Note 2: PUCCH format 1b with channel selection is used to feedback ACK/NACK.

Note 3: For CA test cases, the same PDSCH transmission mode is applied to each component carrier.

Table 8.2.2.3.1A-2: Minimum performance soft buffer management test (FRC) for CA

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
num ber		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Cate gory
1	2x20 MHz	R.30-2 TDD	OP.1 TDD (Note 1)	EVA70	2x2 Low	70	13.2	3
2	2x20 MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA5	2x2 Low	70	15.7	4

Note 1: For CA test cases, the OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

8.2.2.3.1B Enhanced Performance Requirement Type C - 2Tx Antenna Ports

The requirements are specified in Table 8.2.2.3.1B-2, with the addition of the parameters in Table 8.2.2.3.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

Table 8.2.2.3.1B-1: Test Parameters for Large Delay CDD (FRC)

Paramete	•	Unit	Test 1
5	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba	ck mode		Bundling
PDSCH transmissi	on mode		3
Note 1: $P_{R} = 1$			

Table 8.2.2.3.1B-2: Enhanced Performance Requirement Type C for Large Delay CDD (FRC)

Test num ber	Bandwidth	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference of Fraction of Maximum Throughput (%)	value SNR (dB)	UE Cate gory
1	10 MHz	R.11-1 TDD	OP.1 TDD	EVA70	2x2 Medium	70	17.4	≥2

8.2.2.3.1C Enhanced Performance Requirement Type C - 2 Tx Antenna Ports with TM1 interference

The requirements are specified in Table 8.2.2.3.1C-2, with the addition of parameters in Table 8.2.2.3.1C-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of open-loop spatial multiplexing performence with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell with transmission mode 1. In Table 8.2.2.3.1C-1, Cell 1 is the serving cell, and Cell 2 is interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2 respectively.

Table 8.2.2.3.1C-1 Test parameters for Larger Delay CDD (FRC) with TM1 interference

Paramet	ter	Unit	Cell 1	Cell 2			
Bandwid	lth	MHz	10 M	Hz			
Downlink $ ho_{\scriptscriptstyle A}$			-3	0			
power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	0			
allocation	σ		0	0			
Cell-spec reference si			Antenna ports 0,1	Antenna port 0			
Cyclic Pr	efix		Normal	Normal			
Cell ID)		0	1			
Transmission	n mode		3	Note 2			
$N_{\!oc}$ at anten	na port	dBm/15kHz	-98	N/A			
\hat{E}_s/N_{oc} (No	ote 3)	dB	Reference Value in Table 8.2.2.3.1C-2	12.95			
Correlation antenn configura	а		Medium (2x2)	Medium(1x2)			
Number of 0 symbols for F			2	N/A			
Max numb HARQ transm			4	N/A			
Redundancy version coding sequence			{0,1,2,3}	N/A			
Note 1: $P_{\rm B}=1$ Note 2: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.2 applying OCNG pattern OP.5 TDD as defined in							

Annex A.5.2.5.

Note 3: Cell 1 is the serving cell. Cell 2 is the interfering cell.

Note 4:

All cells are time-synchronous.
SIB-1 will not be transmitted in Cell2 in this test. Note 5:

Table 8.2.2.3.1C-2 Enhanced Performance Requirement Type C, Larger Delay CDD (FRC) with TM1 interference

Test Number	Reference Channel	OCNG	Pattern	Propagation Conditions (Note 1)		Reference Value		Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)			
1	R.11-10 TDD	OP.1 TDD	OP.5 TDD	EVA70	EVA70	70	19.6	≥2		

The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1.

8.2.2.3.2 Minimum Requirement 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.3.2-2, with the addition of the parameters in Table 8.2.2.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 4 transmitter antennas.

Table 8.2.2.3.2-1: Test Parameters for Large Delay CDD (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
ACK/NACK feedba			Bundling
PDSCH transmission	on mode		3
Note 1: $P_B = 1$.			

Table 8.2.2.3.2-2: Minimum performance Large Delay CDD (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.14 TDD	OP.1 TDD	EVA70	4x2 Low	70	14.2	≥2

8.2.2.3.3 Minimum Requirement 2Tx antenna port (demodulation subframe overlaps with aggressor cell ABS)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.3-2, with the addition of parameters in Table 8.2.2.3.3-1 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The requirements for MBSFN ABS are specified in Table 8.2.2.3.3-4, with the addition of parameters in Table 8.2.2.3.3-3 and the downlink physical channel setup according to Annex C.3.2 and Annex C.3.3.

The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell. In Tables 8.2.2.3.3-1 and 8.2.2.3.3-3, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.2.2.3.3-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
Uplink downlink config			1	1
Special subframe conf	iguration		4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A
\hat{E}_s/N_{oc2}				6
$BW_Channel$	BW _{Channel}		10	10
Subframe Configur	ation		Non-MBSFN	Non-MBSFN
Cell Id			0	1
Time Offset between	n Cells	μs	2.5 (synchro	nous cells)
ABS pattern (Not	e 5)		N/A	0000010001, 0000000001
RLM/RRM Measurement Pattern (Note 6			000000001, 000000001	N/A
CSI Subframe Sets	Ccsi,0		0000010001, 000000001	N/A
(Note 7)	C _{CSI,1}		1100101000 1100111000	N/A
Number of control OFDI	/I symbols		2	2
ACK/NACK feedback	k mode		Multiplexing	N/A
PDSCH transmission	n mode		3	N/A
Cyclic prefix			Normal	Normal

- Note 1: $P_B = 1$
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 5: ABS pattern as defined in [9].
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.

Table 8.2.2.3.3-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value		UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 2)	
1	R.11 TDD Note 4	OP.1 TDD	OP.1 TDD	EVA 5	EVA 5	2x2 Low	70	14.0	≥2

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

SNR corresponds to \widehat{E}_s/N_{oc2} of cell 1. Note 2:

Note 3:

The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated Note 4: PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms. Note 5:

Table 8.2.2.3.3-3: Test Parameters for Large Delay CDD (FRC) – MBSFN ABS

Parameter		Unit	Cell 1	Cell 2
Uplink downlink confi	guration		1	1
Special subframe conf	iguration		4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A
	N_{oc1}	dBm/15kHz	-102 (Note 2)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A
	N_{oc3}	dBm/15kHz	-94.8 (Note 4)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.2.3.3-4	6
$BW_Channel$		MHz	10	10
Subframe Configu	ration		Non-MBSFN	MBSFN
Cell Id			0	126
Time Offset between	n Cells	μs	2.5 (synchror	nous cells)
ABS pattern (Not	e 5)		N/A	000000001 000000001
RLM/RRM Measuremen Pattern (Note 6			000000001 000000001	N/A
CSI Subframe Sets	C _{CSI,0}		000000001 000000001	N/A
(Note 7)	C _{CSI,1}		1100111000 1100111000	N/A
MBSFN Subframe Allocation (Note 10)			N/A	000010
Number of control OFDM symbols			2	2
ACK/NACK feedbac			Multiplexing	N/A
PDSCH transmission	n mode		3	N/A
Cyclic prefix			Normal	Normal

- Note 1: $P_B = 1$.
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10,#11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbol #0 of a subframe overlapping with the aggressor ABS
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 5: ABS pattern as defined in [9]. The 10th and 20th subframes indicated by ABS pattern are MBSFN ABS subframes.
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 in this test.
- Note 10: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.

Table 8.2.2.3.3-4: Minimum Performance Large Delay CDD (FRC) - MBSFN ABS

Test Number	Reference Channel	OCNG	Pattern	Cond	gation itions te 1)	Correlation Matrix and Antenna	Reference \	/alue	UE Category
		Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Fraction of Maximum (dB) Throughput (Note (%) Note 5 2)		
1	R.11 TDD Note 4	OP.1 TDD	OP.1 TDD	EVA 5	EVA 5	2x2 Low	70	12.2	≥2

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

8.2.2.3.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements for non-MBSFN ABS are specified in Table 8.2.2.3.4-2, with the addition of parameters in Table 8.2.2.3.4-1. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.3.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.3.4-1: Test Parameters for Large Delay CDD (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink confi	guration		1	1	1
Special subframe con	figuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A	N/A
	N_{oc1}	dBm/15kHz	-98 (Note 2)	N/A	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A	N/A
	N_{oc3}	dBm/15kHz	-93 (Note 4)	N/A	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.2.3.4-2	Reference Value in Table 8.2.2.3.4-2	Reference Value in Table 8.2.2.3.4-2
BW _{Channel}		MHz	10	10	10
Subframe Configu	Subframe Configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	1	126
ABS pattern (No	te 5)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			000000001 000000001	N/A	N/A
CSI Subframe Sets	Ccsi,0		0000000001 0000000001	N/A	N/A
(Note7)	Ccsi,1		1100111000 1100111000	N/A	N/A
Number of control OFDM symbols			2	Note 8	Note 8
ACK/NACK feedbac	k mode		Multiplexing	N/A	N/A
PDSCH transmissio			3	Note 9	Note 9
Cyclic prefix			Normal	Normal	Normal

- Note 1: $P_{R} = 1$.
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 5: ABS pattern as defined in [9].
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
- Note 10: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.
- Note 11: SIB-1 will not be transmitted in Cell2 and Cell 3 in this test.

Table 8.2.2.3.4-2: Minimum Performance Large Delay CDD (FRC) - Non-MBSFN ABS

Test Number	Refer ence	\hat{E}_s/N_{oc2}		OCNG Pattern			Propagation Conditions (Note1)			Correlation Matrix and	Reference	Value	UE Cate
	Chan nel	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughp ut (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 TDD Note 4	9	7	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	70	14.2	≥2
2	R.35 TDD Note 4	9	1	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	70	22.7	≥2

- Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.
- Note 3: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.
- Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

8.2.2.4 Closed-loop spatial multiplexing performance

8.2.2.4.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1-2, with the addition of the parameters in Table 8.2.2.4.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.2.4.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1	Test 2
Describely necess	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0
N_{oc} at antenna port		dBm/15kHz	-98	-98
Precoding granula	Precoding granularity		6	50
PMI delay (Note 2	2)	ms	10 or 11	10 or 11
Reporting interva	al	ms	1 or 4 (Note 3)	1 or 4 (Note 3)
Reporting mode			PUSCH 1-2	PUSCH 3-1
CodeBookSubsetRest	riction		001111	001111
bitmap				
ACK/NACK feedback mode			Multiplexing	Multiplexing
PDSCH transmission	mode		4	4

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Table 8.2.2.4.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

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Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
numb	er	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.10 TDD	OP.1 TDD	EVA5	2x2 Low	70	-3.1	≥1
2	10 MHz	R.10 TDD	OP.1 TDD	EPA5	2x2 High	70	-2.8	≥1

8.2.2.4.1A Minimum Requirement Single-Layer Spatial Multiplexing 4 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.1A-2, with the addition of the parameters in Table 8.2.2.4.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband and frequency selective precoding.

Table 8.2.2.4.1A-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Danmlink name	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granul	arity	PRB	6
PMI delay (Note	2)	ms	10 or 11
Reporting inter	val	ms	1 or 4 (Note 3)
Reporting mod	le		PUSCH 1-2
CodeBookSubsetR	estricti		000000000000000000000000000000000000000
on bitmap			000000000000000000000000000000000000000
			00000000000000111
			1111111111111
ACK/NACK feedl	oack		Multiplexing
mode			-
PDSCH transmis	sion		4
mode			
Note 1: $P_B = 1$.			
N (0) (())			P 1 P 1

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Table 8.2.2.4.1A-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Bandwidth	Reference	OCNG	OCNG Propagation Cor		Reference v	/alue	UE		
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category		
1	10 MHz	R.13 TDD	OP.1 TDD	EVA5	4x2 Low	70	-3.5	≥1		

8.2.2.4.1B Enhanced Performance Requirement Type A – Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.2.4.1B-2, with the addition of the parameters in Table 8.2.2.4.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-

one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two dominant interfering cells applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.2.2.4.1B-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.4.1B-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Parameter		Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3	-3
	σ	dB	0	0	0
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{\it oc}$ at antenna po	ort	dBm/15kHz	-98	N/A	N/A
DIP (Note 2)		dB	N/A	-1.73	-8.66
BWchannel		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	2
Number of control OFDM	symbols		2	2	2
PDSCH transmission	mode		6	N/A	N/A
Interference mode	el		N/A	As specified in clause B.5.3	As specified in clause B.5.3
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
Precoding granular	rity	PRB	50	6	6
PMI delay (Note 4	1)	ms	10 or 11	N/A	N/A
Reporting interva	ıİ	ms	5	N/A	N/A
Reporting mode			PUCCH 1-1	N/A	N/A
CodeBookSubsetRestricti	on bitmap		1111	N/A	N/A
ACK/NACK feedback			Multiplexing	N/A	N/A
Physical channel for CQI	reporting		PUSCH(Note 6)	N/A	N/A
cqi-pmi-Configuration	Index		4	N/A	N/A

- Note 1: $P_{B} = 1$
- Note 2: The respective received power spectral density of each interfering cell relative to N_{oc} is defined by its associated DIP value as specified in clause B.5.1.
- Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.
- Note 4: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
- Note 5: All cells are time-synchronous.
- Note 6: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Table 8.2.2.4.1B-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference	Reference Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 TDD	OP. 1 TD D	N/A	N/A	EV A5	EV A5	EV A5	2x2 Low	70	1.1	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.2.2.4.1C Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.2.2.4.1C-2, with the addition of parameters in Table 8.2.2.4.1C-1. The purpose is to verify the closed loop rank-one performance with wideband precoding if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.2.2.4.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.4.1C-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) - Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink confi	guration		1	1	1
Special subframe configuration			4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	N/A	N/A
	N_{oc1}	dBm/15kHz	-98 (Note 2)	N/A	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A	N/A
	N_{oc3}	dBm/15kHz	-93 (Note 4)	N/A	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.2.2.4.1C-2	12	10
BW _{Channel}		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (Not	te 5)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			000000001 000000001	N/A	N/A
CSI Subframe Sets	Ccsi,0		000000001 000000001	N/A	N/A
(Note7)	Ccsi,1		1100111000 1100111000	N/A	N/A
Number of control of symbols	OFDM		2	Note 8	Note 8
ACK/NACK feeback	k mode		Multiplexing	N/A	N/A
PDSCH transmissio	n mode		6	Note 9	Note 9
Precoding granularity		PRB	50	N/A	N/A
PMI delay (Note 10)		ms	10 or 11	N/A	N/A
Reporting inter		ms	1 or 4 (Note 11)	N/A	N/A
Peporting mod			PUSCH 3-1	N/A	N/A
CodeBookSubsetRe bitmap	striction		1111	N/A	N/A
Cyclic prefix	•		Normal	Normal	Normal

- Note 1: $P_{p} = 1$.
- Note 2: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 5: ABS pattern as defined in [9].
- Note 6: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 7: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 9: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
- Note 10: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
- Note 11: For Uplink downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.
- Note 12: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
- Note 13: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Table 8.2.2.4.1C-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)- Non-MBSFN ABS

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions (Note1)			Correlation Matrix and	Reference	Value	UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%) Note 5	SNR (dB) (Note 3)	gory
1	R.11 TDD Note 4	OP.1 TDD	OP.1 FDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 High	70	6.4	≥2

- Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.
- Note 3: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.
- Note 4: Cell 1 Reference channel is modified: PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: The maximum Throughput is calculated from the total Payload in 2 subframes, averaged over 20ms.

8.2.2.4.1D Enhanced Performance Requirement Type B - Single-layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model

The requirements are specified in Table 8.2.2.4.1D-2, with the addition of the parameters in Table 8.2.2.4.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 4 interference model defined in clause B.6.3. In Table 8.2.2.4.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.2.2.4.1D-1: Test Parameters for Single-layer Spatial Multiplexing (FRC) with TM4 interference model

Paran	neter	Unit	Cell 1	Ce	II 2	Ce	Cell 3	
Uplink downlink Cor	nfiguration		1		1		1	
Special subframe co	onfiguration		4		4		4	
	$ ho_{\scriptscriptstyle A}$	dB	-3	-	3	-	3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-	3	-3		
	σ	dB	0		0		0	
Cell-specific referer	nce signals		Antenna ports 0,1	Antenna	ports 0,1	Antenna	ports 0,1	
N _{oc} at antenna por	t	dBm/15 kHz		I	-98			
Test number (Note	4)			Test 1	Test 2	Test 1	Test 2	
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.28	3.34	0.74	
Cell Id				6	1	1	6	
CFI indicated in PC subframes	CFI indicated in PCFICH in normal subframes			3	Random from set {1,2,3}	3	Random from set {1,2,3}	
CFI indicated in PC subframes	CFI indicated in PCFICH in special subframes			2	Random from set {1,2}	2	Random from set {1,2}	
BW _{Channel}		MHz	10	10		1	0	
Cyclic Prefix			Normal	No	rmal	Normal		
Number of control of normal subframes			3	,	3	3		
Number of control C special subframes	OFDM symbols in		2	:	2		2	
PDSCH transmission	on mode		4		4		4	
Interference model			N/A		cified in e B.6.3		cified in e B.6.3	
Precoding	Precoding		Random wideband precoding per TTI		cified in e B.6.3		cified in e B.6.3	
	Time offset to cell 1		N/A		2		3	
	Frequency offset to cell 1		N/A		00		00	
	MBSFN		Not configured		nfigured	Not configured		
r12	p-aList-r12 transmissionMode List-r12		N/A N/A		B-3, dB0} 4,8,9}	{dB-6, dB-3, dB0} {2,3,4,8,9}		

Note 1: $P_B = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells. Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. Note 4: Test 1 and Test 2 are defined in Table 8.2.2.4.1D-2.

Table 8.2.2.4.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, Single-layer Spatial Multiplexing (FRC) with TM4 interference model

Tes Nun		oc	NG Patt	ern		Propagation Conditions		Correlation Reference Value Matrix and			UE Categor
	Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughp ut (%)	SNR (dB) (Note 2)	у
1	R.11-12 TDD	OP.1 TDD	N/A	N/A	EVA 5	EVA 5	EVA 5	2x2 Low	85	16.1	≥1
2	R.11-11 TDD	OP.1 TDD	N/A	N/A	EPA 5	EPA 5	EPA 5	2x2 Low	85	9.5	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to $\hat{E}_{\rm s}/N_{ac}$ of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.2.2.4.1E Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Ports with CRS assistance information

The requirements are specified in Table 8.2.2.4.1E-2, with the addition of parameters in Table 8.2.2.4.1E-1. The purpose is to verify the closed loop rank-one performance with wideband precoding when CRS assistance information [7] is configured. In Table 8.2.2.4.1E-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.2.2.4.1E-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Paramet	er	Unit	Cell 1	Cell 2	Cell 3
Uplink downlink configuration			1	1	1
Special subframe configuration			4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0	0

N_{oc} at antenna	port	dBm/15kHz	-98	N/A	N/A
Ê _s /N _{oc}		dB	Reference Value in Table 8.2.2.4.1E-2	10.45	4.6
BW _{Channel}		MHz	10	10	10
Subframe Config	guration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset to C	ell 1	μs	N/A	3	-1
Frequency shift	to Cell 1	Hz	N/A	300	-100
Cell Id			0	1	128
Cell-specific refe	erence signals		Ante	enna ports 0,1	
Number of contr symbols	ol OFDM		2	2	2
Interference model			N/A	As specified in clause B.5.3	As specified in clause B.5.3
Probability of octor	currence of nterference cells	%	N/A	20	20
Probability of occurrence of	Rank 1	%	N/A	80	80
transmission rank in interfering cells	Rank 2	%	N/A	20	20
ACK/NACK feeb	ack mode		Multiplexing	N/A	N/A
PDSCH transmis	ssion mode		4	N/A	N/A
Precoding granu	larity	PRB	50	N/A	N/A
PMI delay (Note		ms	10 or 11	N/A	N/A
	Reporting interval		1 or 4 (Note 3)	N/A	N/A
Peporting mode			PUSCH 3-1	N/A	N/A
CodeBookSubse bitmap	etRestriction		001111	N/A	N/A
Cyclic prefix			Normal	Normal	Normal
Note 1. D	1				

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Table 8.2.2.4.1E-2: Minimum Performance Single-Layer Spatial Multiplexing (FRC)

Test Number	Reference Channel	OCNG Pattern			Propagation Conditions (Note1)		Correlation Matrix and	Reference	Value	UE Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory
1	R.10-3 TDD	OP.1 TDD	N/A	N/A	EVA5	EVA5	EVA5	2x2 Low	70	11.2	≥2

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to $\mathbb{E}_{\mathfrak{s}}/N_{o\sigma}$ of cell 1.

8.2.2.4.2 Minimum Requirement Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.2-2, with the addition of the parameters in Table 8.2.2.4.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

Table 8.2.2.4.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter	i	Unit	Test 1-2	Test 3
Danielink name	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)
	σ	dB	0	0
N_{oc} at antenna port		dBm/15kHz	-98	-98
Precoding grant	larity	PRB	50	8
PMI delay (Not	PMI delay (Note 2)		10 or 11	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)	1 or 4 (Note 3)
Reporting mo	de		PUSCH 3-1	PUSCH 1-2
ACK/NACK feedba	ck mode		Bundling	Bundling
CodeBookSubsetRo bitmap	estriction		110000	110000
PDSCH transmission	on mode		4	4
Number of OFDM sy PDCCH per compon		OFDM symbol	2	1

Note 1: $P_{R} = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate

between 1ms and 4ms.

Table 8.2.2.4.2-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test number	Band- width	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference of Fraction of Maximum Throughput (%)	/alue SNR (dB)	UE Category	UE DL category
1	10 MHz	R.35 TDD	OP.1 TDD	EPA5	2x2 Low	70	19.5	≥2	≥6
2	10 MHz	R.11-1 TDD	OP.1 TDD	ETU70	2x2 Low	70	13.9	≥2	≥6
3	20 MHz 256QA M	R. 65 TDD	OP.1 TDD	EVA5	2x2 Low	70	24.9	11-12	≥11

8.2.2.4.2A Enhanced Performance Requirement Type C Multi-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.2.2.4.2A-2, with the addition of the parameters in Table 8.2.2.4.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband precoding.

Table 8.2.2.4.2A-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
N_{oc} at antenna	port	dBm/15kHz	-98
Precoding granu		PRB	50
PMI delay (Not	e 2)	ms	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)
Reporting mo	de		PUSCH 3-1
ACK/NACK feedba	ck mode		Bundling
CodeBookSubsetRe bitmap	estriction		110000
PDSCH transmission	on mode		4

Note 1: $P_{R} = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF

not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval

will alternate between 1ms and 4ms.

Table 8.2.2.4.2A-2: Enhanced Performance Requirement Type C for Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.11-1 TDD	OP.1 TDD	ETU70	2x2 Medium	70	17.8	≥2

8.2.2.4.3 Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port

For single carrier, the requirements are specified in Table 8.2.2.4.3-2, with the addition of the parameters in Table 8.2.2.4.3-1 and the downlink physical channel setup according to Annex C.3.2.

For CA with 2 DL CCs, the requirements are specified in Table 8.2.2.4.3-4, with the addition of the parameters in Table 8.2.2.4.3-3 and the downlink physical channel setup according to Annex C.3.2.The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For CA with 3 DL CCs, the requirements are specified in Table 8.2.2.4.3-7, based on single carrier requirement specified in Table 8.2.2.4.3-5, with the addition of the parameters in Table 8.2.2.4.3-3 and the downlink physical channel setup according to Annex C.3.2.

For CA with 4 DL CCs, the requirements are specified in Table 8.2.2.4.3-8, based on single carrier requirement specified in Table 8.2.2.4.3-5, with the addition of the parameters in Table 8.2.2.4.3-3 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.2.4.3-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-6
allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granu	larity	PRB	6
PMI delay (Not	e 2)	ms	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)
Reporting mo	de		PUSCH 1-2
ACK/NACK feedba	ck mode		Bundling
CodeBookSubsetRe	estriction		000000000000000000000000000000000000000
bitmap			000011111111111111111100000000
			0000000
PDSCH transmission	on mode		4
		·	·

Note 1: $P_B = 1$.

If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this Note 2:

reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate

between 1ms and 4ms.

Note 4: Void. Note 5: Void. Note 6: Void.

Table 8.2.2.4.3-2: Minimum performance Multi-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagatio	Correlation	Reference	value	UE
number	width	Channel	Pattern	n Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz	R.36 TDD	OP.1 TDD	EPA5	4x2 Low	70	15.7	≥2
Note 1:	Void							

Table 8.2.2.4.3-3: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Parameter		Unit	Value
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granu	larity	PRB	8
PMI delay (Not	e 2)	ms	10 or 11
Reporting inte	Reporting interval		1 or 4 (Note 3)
Reporting mo	de		PUSCH 1-2
ACK/NACK feedba	ck mode		PUCCH format 1b with channel selection for Tests in Table 8.2.2.4.3-4; PUCCH format 3 for Tests in Table 8.2.2.4.3-7 and Table 8.2.2.4.3-8.
CodeBookSubsetRestriction bitmap			00000000000000000000000000000000000000
CSI request field (Note 4)		'10'
PDSCH transmission			4

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Note 4: Multiple CC-s under test are configured as the 1st set of serving cells by high layers.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.2.4.3-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for CA with 2DL CCs

Test	Band-	Reference				Reference	/alue	UE
number	width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	2x20 MHz	R.43 TDD	OP.1 TDD (Note 1)	EVA5	4x2 Low	70	11.1	≥5
2	20MHz +15MH z	R.43 TDD for 20MHz CC	OP.1 TDD (Note 1)	EVA5	4x2 Low	70	10.7	≥5
		R.43-5 TDD for 15MHz CC	OP.1 TDD (Note 1)				10.6	

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.2.2.4.3-5: Single carrier performance for multiple CA configurations

			Propa-	Correlation	Referenc	e value
Band- width	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10 MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP. 1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.2.4.3-6: Void

Table 8.2.2.4.3-7: Minimum performance (FRC) based on single carrier performance for CA with 3 DL CCs

Test num. CA Band-width combination		Requirement	UE category					
1	3x20MHz	As specified in Table 8.2.2.4.3-5 per CC	≥5					
2	20MHz+20MHz+15MHz	As specified in Table 8.2.2.4.3-5 per CC	≥5					

Table 8.2.2.4.3-8: Minimum performance (FRC) based on single carrier performance for CA with 4 DL CCs

Test num.	CA Band-width combination	Requirement	UE category				
1 4x20MHz		As specified in Table 8.2.2.4.3-5 per CC	≥8				
2 20MHz+20MHz+20MHz+15MHz		As specified in Table 8.2.2.4.3-5 per CC	≥8				

8.2.2.4.3A Minimum Requirement Multi-Layer Spatial Multiplexing 4 Tx Antenna Port for dual connectivity

For dual connectivity the requirements are specified in Table 8.2.2.4.3A-3, for 2DL CCs, in Table 8.2.2.4.3A-4 for 3DL CCs, and Table 8.2.2.4.3A-5 for 4DL CCs, based on single carrier requirement specified in Table 8.2.2.4.3A-2, with the addition of the parameters in Table 8.2.2.4.3A-1 and the downlink physical channel setup according to Annex C.3.2.The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding by using dual connectivity.

Table 8.2.2.4.3A-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

Parameter		Unit	Value		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)		
	σ	dB	3		
$N_{\it oc}$ at antenna port		dBm/15kHz	-98		
Precoding granularit	у	PRB	6 for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, and 8 for 15MHz CCs and 20MHz CCs		
PMI delay (Note 2)		ms	10 or 11		
Reporting interval		ms	1 or 4 (Note 3)		
Reporting mode			PUSCH 1-2		
CodeBookSubsetRestriction bitmap			00000000000000000000000000000000000000		
PDSCH transmission	n mode		4		
ACK/NACK transmis	ssion		Separate ACK/NACK feedbacks with PUCCH format 1b on the MCG and SCG		
CSI feedback			Separate PUSCH feedbacks on the MCG and SCG		
Time offset between MCG CC and SCG CC		μѕ	0 for UE under test supporting synchronous dual connectivity; 334 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 5)		
Note 1: $P_B = 1$. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)					

For Uplink - downlink configuration 1 the reporting interval will alternate Note 3:

between 1ms and 4ms.

The same PDSCH transmission mode is applied to each component carrier. Note 4:

Note 5:

As defined in TS36.300 [11].

If the UE supports both SCG bearer and Split bearer, the SCG bearer is Note 6:

configured.

Table 8.2.2.4.3A-2: Single carrier performance for multiple dual connectivity configurations

				Correlation	Reference	value
Band- width	Reference channel	OCNG pattern	Propa- gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10 MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP. 1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.2.4.3A-3: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

Test num. Band-width combination Requirement UE category		Test num.	Band-width combination	Requirement	UE category
--	--	-----------	------------------------	-------------	-------------

1	2x20 MHz	As specified in Table 8.2.2.4.3A-2 per CC	≥5			
Note 1:	The OCNG pattern applies for each	CC.				
Note 2:	The applicability of requirements for different dual connectivity configurations and bandwidth					
	combination sets is defined in 8.1.2.3	3A.				

Table 8.2.2.4.3A-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

Test num. Ba		Band-width combination	Requirement	UE category			
1	1 3x20 MHz		As specified in Table 8.2.2.4.3A-2 per CC	≥5			
Note 1:	The	OCNG pattern applies for each	CC.				
Note 2:	Note 2: The applicability of requirements for different dual connectivity configurations and bandwidth						
	com	bination sets is defined in 8.1.2.3	3A.				

Table 8.2.2.4.3A-5: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

Test num.		Band-width combination	Requirement	UE category		
1	1 4x20 MHz		As specified in Table 8.2.2.4.3A-2 per CC	≥8		
2	2 15+20+20Hz		As specified in Table 8.2.2.4.3A-2 per CC	≥8		
Note 1:	Note 1: The OCNG pattern applies for each CC.					
Note 2:	Note 2: The applicability of requirements for different dual connectivity configurations and bandwidth					
	combination sets is defined in 8.1.2.3A.					

8.2.2.4.4 Void

8.2.2.5 MU-MIMO

8.2.2.6 [Control channel performance: D-BCH and PCH]

8.2.2.7 Carrier aggregation with power imbalance

The requirements in this section verify the ability of an intraband adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only.

8.2.2.7.1 Minimum Requirement

For CA, the requirements are specified in Table 8.2.2.7.1-2, with the addition of the parameters in Table 8.2.2.7.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.2.7.1-1: Test Parameters for CA

Parameter		Unit	Test 1	Test 2	
Davinlink navyan	$ ho_{\scriptscriptstyle A}$	dB	0	0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	
	σ	dB	0	0	
$N_{\it oc}$ at antenna poi	t	dBm/15kHz	Off (Note 2)	Off (Note 2)	
Symbols for unused	d PRBs		OCNG (Note 3)	OCNG (Note 3)	
Modulation			64 QAM	64 QAM	
Maximum number of transmission	of HARQ		1	1	
Redundancy version sequence	n coding		{0}	{0}	
PDSCH transmission of PCell	on mode		1	3	
PDSCH transmission of SCell	on mode		3	1	
OCNG Pattern	PCell		OP.1 TDD	OP.5 TDD	
OCNG Pattern	SCell		OP.5 TDD	OP.1 TDD	
Propagation PCell			Clause B.1	Clause B.1	
Conditions SCell			Clause B.1	Clause B.1	
Correlation Matrix	Correlation Matrix PCell		1x2	2x2	
and Antenna	SCell	7 1 (0 0	2x2	1x2	

Note 1: $P_{\rm B}=0$ for 1x2 and $P_{\rm B}=1$ for 2x2 antenna configuration.

No external noise sources are applied. Note 2:

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data.

Note 4: Void.

Table 8.2.2.7.1-2: Minimum performance (FRC) for CA

Test Number			Referenc	e channel	Power at antenna port (dBm/15KHz)		Reference value Fraction of Maximum Throughput (%)		UE Category
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell}	\hat{E}_{s_SCell}	PCell	SCell	
					for PCell	for Scell			
1	20	20	R.49 TDD	NA	-85	-79	85	NA	≥5
2	20	15	NA	R.49-1 TDD	-79	-85.8	NA	85	≥5

Note 1: The OCNG pattern for PCell is used to fill the control channel. The OCNG pattern for SCell is used to fill the control channel and PDSCH.

The applicability of requirements for different CA configurations and bandwidth combination sets is defined Note 2: in 8.1.2.3.

8.2.2.8 Intra-band contiguous carrier aggregation with minimum channel spacing

The requirements in this section verify the ability of an UE supporting intraband contiguous carrier aggregation with minimum channel spacing to demodulate the signal transmitted by the PCell and SCell(s). Throughput is measured on each cell. The minimum channel spacing of intra-band contiguous carrier aggregation refers to the possible minimum channel spacing as any multiple of 300 kHz less than the nominal channel spacing defined in 5.7.1A.

8.2.2.8.1 Minimum Requirement

For CA the requirements are specified in Table 8.2.2.8.1-2, with the addition of the parameters in Table 8.2.2.8.1-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.2.2.8.1-1: Test Parameters for CA

	Parameter	Unit	Test 1-2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	0
$N_{\it oc}$ at anten	$N_{\scriptscriptstyle oc}$ at antenna port		-98
Symbols for t	unused PRBs		OCNG (Note 2)
Modulation			64QAM
ACK/NACK feedback mode			PUCCH format 1b with channel selection for Test 1; PUCCH format 3 for Test 2
PDSCH trans	smission mode		1

 $P_B = 0$ Note 1:

These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated Note 2:

pseudo random data, which is QPSK modulated.

The same PDSCH transmission mode is applied to each component carrier. Note 3:

Table 8.2.2.8.1-2: Minimum performance (FRC) for intra-band CA with minimum channel spacing

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number		Channel	Pattern	Condition	Matrix and Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	2x20MHz	R.9 TDD	OP.1 TDD (Note 1)	EVA5	1x2 Low	70	17.16	≥5
		R.9 TDD	OP.1 TDD (Note 1)			70	17.16	
2	3x20MHz	R.9 TDD	OP.1 TDD (Note 1)	EVA5	1x2 Low	70	17.16	≥5
		R.9 TDD	OP.1 TDD (Note 1)			70	17.16	
		R.9 TDD	OP.1 TDD (Note 1)			70	17.16	

The OCNG pattern applies for each CC. Note 1:

The applicability and test rules of requirements for different CA configurations and bandwidth combination sets Note 2: are defined in 8.1.2.3.

TDD FDD CA (Fixed Reference Channel) 8.2.3

The parameters specified in Table 8.2.3-1 are valid for all the TDD FDD CA tests unless otherwise stated.

Parameter Unit Value Uplink downlink configuration (Note 1) 1 for TDD CC only Special subframe configuration (Note 4 2) for TDD CC only Inter-TTI Distance 1 Maximum number of FDD PCell **Processes** 8 for FDD and TDD CCs HARQ processes per TDD PCell 11 for FDD CC; 7 for TDD CC component carrier **Processes** Maximum number of HARQ 4 transmission {0,1,2,3} for QPSK and 16QAM Redundancy version coding sequence {0,0,1,2} for 64QAM 4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 Number of OFDM symbols for **OFDM** MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz PDCCH per component carrier symbols bandwidths Cyclic Prefix Normal Cell_ID 0 Cross carrier scheduling Not configured ACK/NACK feedback mode **PUCCH format 3** FDD PCell As specified in Clause 7.3.3 in TS36.213 [6] Downlink HARQ-ACK timing TDD PCell As specified in Clause 7.3.4 in TS36.213 [6] Note 1: as specified in Table 4.2-2 in TS 36.211 [4].

Table 8.2.3-1: Common Test Parameters

The applicability of ther requirements are specified in Clause 8.1.2.3. The single carrier performance with different bandwidths for multiple CA configurations specified in Clause 8.2.3 cannot be applied for UE single carrier test.

8.2.3.1 Single-antenna port performance

Note 2:

as specified in Table 4.2-1 in TS 36.211 [4].

The single-antenna performance in a given multi-path fading environments is determined by the SNR for which a certain relative information bit throughput of the reference measurement channels in Annex A.3.3 is achieved. The purpose of these tests is to verify the single-antenna performance with different channel models and MCS.

8.2.3.1.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.1.1-4 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.1.1-5 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with FDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.1.1-6 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with FDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.1.1-7 based on single carrier requirement specified in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3, with the addition of the parameters in Table 8.2.3.1.1-1 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.1.1-1: Test Parameters for CA

Par	rameter	Unit	Value
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
allocation	σ	dB	0
N_{oc} at antenna port		dBm/15kHz	-98
Symbols fo	r unused PRBs		OCNG (Note 2)
Mo	dulation		QPSK
PDSCH trai	nsmission mode		1

Note 1: $P_{B} = 0$.

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs

shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.1.1-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.3
3 MHz	R.42-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.1
5MHz	R.42-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0
10MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7
15MHz	R.42-3 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.6
20MHz	R.42 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7

Table 8.2.3.1.1-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.6
3 MHz	R.42-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.8
5MHz	R.42-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2
10MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.6
15MHz	R.42-3 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4
20MHz	R.42 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4

Table 8.2.3.1.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test numbe	CA Bandwidth combination (MHz)		bination	Minimum performance requirement		
r	Total	FDD CC	TDD CC			
1	2x20	20	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
2	20+10	10	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
3	20+15	15	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.					
Note 2:		ing differend n any FDD (Cell and any SCell is applied in inter-band CA case, where PC	Cell can be	

Table 8.2.3.1.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test number	CA Bandwidth combination (MHz)		bination	Minimum performance requirement	UE Categor V	
	Total	FDD CC	TDD CC			
1	3x20	20	2x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
2	20+20+15	15	2x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
3	20+20+10	10	2x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
4	3x20	2x20	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
5	20+20+15	20+15	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
6	20+20+10	20+10	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
7	20+10+10	2x10	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5	
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.					
Note 2:		ng difference any FDD C		ell and any SCell is applied in inter-band CA case, where PCell ca	an be	

Table 8.2.3.1.1-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test number	CA Bandwidth combination (MHz)		nation	Minimum performance requirement	UE Category
	Total	FDD CC	TDD CC		
1	4x20	20	3x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8
4	2×15+2x2 0	2×15	2x20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8
6	2×15+2x2 0	2x15+20	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8
7	3x20+10	2x20+10	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥8
Note 1:	The applicat	oility of require	ments for c	lifferent CA configurations and bandwidth combination sets is def	ined in

8.1.2.3B.

30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be Note 2: assigned on any CC.

Table 8.2.3.1.1-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test number	CA Bandy	CA Bandwidth combination (MHz)				UE Category		
	Total	FDD CC	TDD CC					
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11			
2	2×15+3×20	2×15+20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11			
Note 1:	e 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.							
Note 2:	J		30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC.					

8.2.3.1.2 Minimum Requirement for TDD PCell

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.1.2-4 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with TDD PCell with 3DL CCs, the requirements are specified in Table 8.2.3.1.2-5 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with TDD PCell with 4DL CCs, the requirements are specified in Table 8.2.3.1.2-6 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

For TDD FDD CA with TDD PCell with 5DL CCs, the requirements are specified in Table 8.2.3.1.2-7 based on single carrier requirement specified in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3, with the addition of the parameters in Table 8.2.3.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.1.2-1: Test Parameters for CA

Pa	rameter	Unit	Value
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
allocation	σ	dB	0
N_{oc} at	N_{oc} at antenna port		-98
Symbols fo	or unused PRBs		OCNG (Note 2)
Мо	dulation		QPSK
PDSCH tra	nsmission mode		1

Note 1: $P_{R} = 0$.

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 3: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.1.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.4 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.3
3 MHz	R.42-1 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.1
5MHz	R.42-2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.0
10MHz	R.2 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7
15MHz	R.42-3 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.6
20MHz	R.42 FDD	OP.1 FDD	EVA5	1x2 Low	70	-1.7

Table 8.2.3.1.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	width Channel		Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.4 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.6
3 MHz	R.42-1 TDD	OP.1 TDD	EVA5	1x2 Low	70	-0.8
5MHz	R.42-2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.2
10MHz	R.2 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.6
15MHz	R.42-3 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4
20MHz	R.42 TDD	OP.1 TDD	EVA5	1x2 Low	70	-1.4

Table 8.2.3.1.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)		dth (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	2x20	20	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
2	20+10	10	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
3	20+15	15	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B

Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any TDD CC.

Table 8.2.3.1.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	Test Aggregated Bandwidth (MHz) number Total FDD CC TDD CC		dth (MHz)	Minimum performance requirement	UE
number			TDD CC		Category
1	3x20	20	2x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
2	20+20+15	15	2x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
3	20+20+10	10	2x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
5	20+20+15	20+15	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
6	20+20+10	20+10	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5
7	20+10+10	2x10	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥5

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.

Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any TDD CC.

Table 8.2.3.1.2-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test numbe	CA Bandwidth combination (MHz)			Minimum performance requirement	UE Category
r	Total	FDD CC	TDD CC		
1	4x20	20	3x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8
4	2×15+2x2 0	2×15	2x20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8
6	2×15+2x2 0	2x15+20	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8
7	3x20+10	2x20+10	20	As defined in Table 8.2.3.1.2-2 and Table 8.2.3.1.2-3 per CC	≥8

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.

Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC.

Table 8.2.3.1.2-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)		(MHz)	Minimum performance requirement	UE
number	Total	FDD CC	TDD CC		Category
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11
2	2×15+3×20	2×15+20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.

Note 2: 30usec timing difference between PCell and any SCell is applied in inter-band CA case, where PCell can be assigned on any CC.

8.2.3.2 Open-loop spatial multiplexing performance 2Tx Antenna port

8.2.3.2.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.2.1-4 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.2.1-5 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with FDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.2.1-6 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with FDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.2.1-7 based on single carrier requirement specified in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3, with the addition of the parameters in Table 8.2.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.2.1-1: Test Parameters for Large Delay CDD (FRC) for CA

Parameter		Unit	Value
December a second	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		3

Note 1: $P_{p} = 1$.

Note 2: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.2.1-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.11-5 FDD	OP.1 FDD	EVA70	2x2 Low	70	13.6
3 MHz	R.11-6 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3
5MHz	R.11-2 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3
10MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9
15MHz	R.11-7 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.8
20MHz	R.30 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9

Table 8.2.3.2.1-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.11-5 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.2
3 MHz	R.11-6 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
5MHz	R.11-7 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.6
10MHz	R.11-8 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
15MHz	R.11-9 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.9
20MHz	R.30-1 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.0

Table 8.2.3.2.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement	UE
numbe r	Total FDD CC		TDD CC		Category
1	2x20	20	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
2	20+10	10	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
3	20+15	15	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
Note 1:	The applica 8.1.2.3B	ability of requ	irements for	different CA configurations and bandwidth combination sets is	defined in

Table 8.2.3.2.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement	UE
number	Total FDD CC		TDD CC		Category
1	3x20	20	2x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
2	20+20+15	15	2x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
3	20+20+10	10	2x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
5	20+20+15	20+15	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
6	20+20+10	20+10	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥5
7	20+10+10	2x10	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5
Note 1:	The applicab	ility of requi	rements for o	different CA configurations and bandwidth combination sets is de	fined in
	8.1.2.3B.			•	

Table 8.2.3.2.1-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test	Aggregated	d Bandwidth	(MHz)	Minimum performance requirement	UE
numb er			TDD CC		Category
1	4x20	20	3x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
4	2×15+2x20	2×15	2x20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
6	2×15+2x20	2x15+20	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
7	3x20+10	2x20+10	20	As defined in Table 8.2.3.2.1-2 and Table 8.2.3.2.1-3 per CC	≥8
Note 1:	The applicab	ility of require	ements for	different CA configurations and bandwidth combination sets is d	lefined in

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.

Table 8.2.3.2.1-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test	Aggregated	Aggregated Bandwidth (MHz)		Minimum performance requirement	UE	
number	Total FDD CC TDD		TDD		Category	
		cc				
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11	
2	2×15+3×20	2×15+20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11	
Note 1:	The applicabili	ty of requirer	nents for d	lifferent CA configurations and bandwidth combination sets is defined in		

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3B.

8.2.3.2.1A Soft buffer management test for FDD PCell

For TDD-FDD CA, the requirements are specified in Table 8.2.3.2.1A-2, with the addition of the parameters in Table 8.2.3.2.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation for FDD as PCell.

Table 8.2.3.2.1A-1: Test Parameters for CA

	Parameter		Value			
			FDD Carrier	TDD Carrier		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3	-3		
power	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)		
allocation	σ	dB	0	0		
N_{oc} at antenna port		dBm/15kHz	-98	-98		
PDSCH	transmission mode		3	3		

Note 1: $P_{R} = 1$.

Note 2: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.2.1A-2: Minimum performance (FRC) for CA

						Correl	Reference v	alue	
Test num.	Band	l-width	Reference channel	OCNG pattern	Propa- gation condi-tion	ation matrix and anten na config	Fraction of maximum throughput (%)	SNR (dB)	UE cate gory
1	PCell	20MHz	R.30 FDD	OP.1 FDD (Note 1)	E\/\\\ 70	2x2	70	13.2	2
'	SCell	20MHz	R.30-2 TDD	OP.1 TDD (Note 1)	EVA70	Low	70	13.2	3
2	PCell	20MHz	R.35-1 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.3	4
2	SCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA/O	Low	70	16.3	
3	PCell	10MHz	R.35-3 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.0	3
3	SCell	20MHz	R.30-2 TDD	OP.1 TDD (Note 1)	EVATO	Low	70	13.2	3
4	PCell	10MHz	R.35-3 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.0	4
4	SCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVATO	Low	70	16.3	
5	PCell	15MHz	R.35-2 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.0	3
3	SCell	20MHz	R.30-2 TDD	OP.1 TDD (Note 1)	EVA/U	Low	70	13.2	
6	PCell	15MHz	R.35-2 FDD	OP.1 FDD (Note 1)	EVA70	2x2	70	16.0	4
0	SCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	EVA/U	Low	70	16.3	4

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are defined in 8.1.2.3B.

8.2.3.2.2 Minimum Requirement for TDD PCell

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.2.2-4 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.2.2-5 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.2.2-6 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

For TDD FDD CA with TDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.2.2-7 based on single carrier requirement specified in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3, with the addition of the parameters in Table 8.2.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of large delay CDD with 2 transmitter antennas.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.2.2-1: Test Parameters for Large Delay CDD (FRC) for CA

Parameter		Unit	Value
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		3

Note 1: $P_B = 1$.

Note 2: The same PDSCH transmission mode is applied to each

component carrier.

Table 8.2.3.2.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.11-5 FDD	OP.1 FDD	EVA70	2x2 Low	70	13.6
3 MHz	R.11-6 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3
5MHz	R.11-2 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3
10MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9
15MHz	R.11-7 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.8
20MHz	R.30 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9

Table 8.2.3.2.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.11-5 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.2
3 MHz	R.11-6 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
5MHz	R.11-7 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.6
10MHz	R.11-8 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8
15MHz	R.11-9 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.9
20MHz	R.30-1 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.0

Table 8.2.3.2.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Aggrega	ted Bandwi	dth (MHz)	Minimum performance requirement	UE
numbe r	Total FDD CC		TDD CC		Category
1	2x20	20	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
2	20+10	10	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
3	20+15	15	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
Note 1:	The applica 8.1.2.3B	ability of requ	uirements for	different CA configurations and bandwidth combination sets is	defined in

Table 8.2.3.2.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	Aggregate	ed Bandwid	th (MHz)	Minimum performance requirement	UE
number	Total	FDD CC	TDD CC		Category
1	3x20	20	2x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
2	20+20+15	15	2x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
3	20+20+10	10	2x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
5	20+20+15	20+15	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
6	20+20+10	20+10	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
7	20+10+10	2x10	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥5
Note 1:	The applicabil 8.1.2.3B.	lity of require	ments for dif	ferent CA configurations and bandwidth combination sets is	s defined in

8.1.2.3B.

Table 8.2.3.2.2-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test	Aggregat	ed Bandwidt	h (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	4x20	20	3x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
4	2×15+2x 20	2×15	2x20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
6	2×15+2x 20	2x15+20	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
7	3x20+10	2x20+10	20	As defined in Table 8.2.3.2.2-2 and Table 8.2.3.2.2-3 per CC	≥8
Note 1:	The applica	ability of requi	rements fo	r different CA configurations and bandwidth combination sets	is defined in

Table 8.2.3.2.2-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test	Aggregated	d Bandwidth	(MHz)	Minimum performance requirement	UE
number	Total	FDD CC TDD CC			Category
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11
2	2×15+3×20	2×15+20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11
Note 1:	The applicabili 8.1.2.3B.	ity of requirer	ments for o	different CA configurations and bandwidth combination sets is def	fined in

8.2.3.2.2A Soft buffer management test for TDD PCell

For TDD-FDD CA, the requirements are specified in Table 8.2.3.2.2A-2, with the addition of the parameters in Table 8.2.3.2.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the UE performance with proper instantaneous buffer implementation for TDD as PCell.

Table 8.2.3.2.2A-1: Test Parameters for CA

	Parameter		Value		
			FDD Carrier	TDD Carrier	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	
power	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	
allocation	σ	dB	0	0	
N_{oc} at antenna port		dBm/15kHz	-98	-98	
PDSCH transmission mode			3	3	

Note 1: $P_B = 1$.

Note 2: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.2.2A-2: Minimum performance (FRC) for CA

						Correl	Reference v	alue	
Test num.	Band	l-width	Reference channel	OCNG pattern	Propa- gation condi-tion	ation matrix and anten na config	Fraction of maximum throughput (%)	SNR (dB)	UE cate gory
1	PCell	20MHz	R.30-2 TDD	OP.1 TDD (Note 1))	EVA70	2x2	70	13.2	3
'	SCell	20MHz	R.30 FDD	OP.1 FDD (Note 1		Low	70	13.2	3
2	PCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	F)/A70	2x2	70	16.2	4
2	2 SCell	20MHz	R.35-1 FDD	OP.1 FDD (Note 1)	EVA70	Low	70	16.2	_
2	PCell	20MHz	R.30-2 TDD	OP.1 TDD (Note 1)	EVA70	2x2	70	13.2	3
3	SCell	10MHz	R.35-3 FDD	OP.1 FDD (Note 1)	EVA/U	Low	70	16.0	١
4	PCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	E)/A70	2x2	70	16.2	4
4	SCell	10MHz	R.35-3 FDD	OP.1 FDD (Note 1)	EVA70	Low	70	15.8	4
	PCell	20MHz	R.30-2 TDD	OP.1 TDD (Note 1)	F)/A70	2x2	70	13.2	
5	SCell	15MHz	R.35-2 FDD	OP.1 FDD (Note 1)	EVA70	Low	70	15.8	3
	PCell	20MHz	R.35-1 TDD	OP.1 TDD (Note 1)	F)/A70	2x2	70	16.2	4
6	SCell	15MHz	R.35-2 FDD	OP.1 FDD (Note 1)	EVA70	Low	70	15.8	4

Note 1: The OCNG pattern applies for each CC.

Note 2: The applicability and test rules of requirements for different CA configurations and bandwidth combination sets are defined in 8.1.2.3B.

8.2.3.3 Closed-loop spatial multiplexing performance 4Tx Antenna Port

8.2.3.3.1 Minimum Requirement for FDD PCell

For TDD FDD CA with FDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.3.1-4 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with FDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.3.1-5 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with FDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.3.1-6 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with FDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.3.1-7 based on single carrier requirement specified in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3, with the addition of the parameters in Table 8.2.3.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.3.1-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Paramete	r	Unit	Value
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenn	a port	dBm/15kHz	-98
Precoding gran	ularity	PRB	Wideband precoding for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs
DMI dolov (Noto 2)	FDD CC	ms	8
PMI delay (Note 2)	TDD CC	ms	10 or 11
Reporting interval	FDD CC	ms	1
Reporting interval	TDD CC	ms	1 or 4 (Note 3)
Reporting m	ode		PUSCH 1-2
CodeBookSubsetF	Restriction		000000000000000000000000000000000000000
bitmap			00001111111111111111100000000
			0000000
CSI request field	(Note 3)		'10'
PDSCH transmiss	ion mode		4

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this

reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Multiple CC-s under test are configured as the 1st set of serving cells by higher layers

Note 4: ACK/NACK bits are transmitted using PUSCH with PUCCH format 3.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.3.1-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD PCell and SCell (FRC)

Band-	Band- Reference		Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.14-4 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.4
3 MHz	R.14-5 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
5MHz	R.14-6 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
10MHz	R.14 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
15MHz	R.14-7 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
20MHz	R.14-3 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.3

Table 8.2.3.3.1-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3 MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.3.3.1-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement	UE
numbe r	Total FDD CC TDD CC		TDD CC		Category
1	2x20	20	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
2	20+10	10	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
3	20+15	15	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
Note 1:	The applica 8.1.2.3B	ability of requ	irements for	different CA configurations and bandwidth combination sets is	defined in

Table 8.2.3.3.1-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement	UE
number	Total FDD CC TDD C		TDD CC		Category
1	3x20	20	2x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
2	20+20+15	15	2x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
3	20+20+10	10	2x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
5	20+20+15	20+15	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
6	20+20+10	20+10	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
7	20+10+10	2x10	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥5
Note 1:	The applical 8.1.2.3B.	oility of requi	rements for o	different CA configurations and bandwidth combination sets is def	ined in

Table 8.2.3.3.1-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test	Aggregat	ed Bandwidt	h (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	4x20	20	3x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
4	2×15+2x 20	2×15	2x20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
6	2×15+2x 20	2x15+20	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
7	3x20+10	2x20+10	20	As defined in Table 8.2.3.3.1-2 and Table 8.2.3.3.1-3 per CC	≥8
Note 1:	The application 8.1.2.3B.	ability of requi	rements fo	r different CA configurations and bandwidth combination sets	is defined in

Table 8.2.3.3.1-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test	33 3 3 3 3 4 4 7		(MHz)	Minimum performance requirement	UE
number	Total	FDD CC	TDD CC		Category
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11
2	2×15+3×20	2×15+20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11
Note 1:	The applicabili	ity of requirer	nents for d	lifferent CA configurations and bandwidth combination sets is def	ined in

8.2.3.3.2 Minimum Requirement for TDD PCell

For TDD FDD CA with TDD PCell and 2DL CCs, the requirements are specified in Table 8.2.3.3.2-4 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with TDD PCell and 3DL CCs, the requirements are specified in Table 8.2.3.3.2-5 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with TDD PCell and 4DL CCs, the requirements are specified in Table 8.2.3.3.2-6 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

For TDD FDD CA with TDD PCell and 5DL CCs, the requirements are specified in Table 8.2.3.3.2-7 based on single carrier requirement specified in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3, with the addition of the parameters in Table 8.2.3.3.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.3.3.2-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for CA

Paramete	r	Unit	Value
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenn	a port	dBm/15kHz	-98
Precoding gran	ularity	PRB	Widelband pre-coding for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs
DMI dolov (Noto 2)	FDD CC	ms	8
PMI delay (Note 2)	TDD CC	ms	10 or 11
Reporting interval	FDD CC	ms	1
Reporting interval	TDD CC	ms	1 or 4 (Note 3)
Reporting m	ode		PUSCH 1-2
CodeBookSubsetRestriction bitmap			00000000000000000000000000000000000000
CSI request field	(Note 3)		'10'
PDSCH transmiss	ion mode		TM4

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Multiple CC-s under test are configured as the 1st set of serving cells by higher

layers.

Note 4: ACK/NACK bits are transmitted using PUSCH with PUCCH format 3.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.3.3.2-2: Single carrier performance with different bandwidths for multiple CA configurations for FDD SCell (FRC)

Band-	Band- Reference		Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.14-4 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.4
3 MHz	R.14-5 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
5MHz	R.14-6 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
10MHz	R.14 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
15MHz	R.14-7 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
20MHz	R.14-3 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.3

Table 8.2.3.3.2-3: Single carrier performance with different bandwidths for multiple CA configurations for TDD PCell and SCell (FRC)

Band-	Reference	OCNG	Propagation	Correlation	Reference	value
width	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
1.4 MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3 MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.3.3.2-4: Minimum performance for multiple CA configurations with 2DL CCs (FRC)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement	UE
numbe r	Total FDD CC		TDD CC		Category
1	2x20	20	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
2	20+10	10	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
3	20+15	15	20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	≥5
Note 1:	The applica 8.1.2.3B	ability of requ	irements for	different CA configurations and bandwidth combination sets is	defined in

Table 8.2.3.3.2-5: Minimum performance for multiple CA configurations with 3DL CCs (FRC)

Test	Aggregat	ted Bandwi	dth (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	3x20	20	2x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
2	20+20+1 5	15	2x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
3	20+20+1 0	10	2x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
4	3x20	2x20	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
5	20+20+1 5	20+15	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
6	20+20+1 0	20+10	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
7	20+10+1 0	2x10	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥5
Note 1:	The applica	ability of requ	uirements for	different CA configurations and bandwidth combination sets is	defined in

Table 8.2.3.3.2-6: Minimum performance for multiple CA configurations with 4DL CCs (FRC)

Test	Aggregat	ed Bandwidt	h (MHz)	Minimum performance requirement	UE
numbe r	Total	FDD CC	TDD CC		Category
1	4x20	20	3x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
2	4x20	2×20	2×20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
3	3x20+15	20+15	2×20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
4	2×15+2x 20	2×15	2x20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
5	3x20+15	2×20+15	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
6	2×15+2x 20	2x15+20	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
7	3x20+10	2x20+10	20	As defined in Table 8.2.3.3.2-2 and Table 8.2.3.3.2-3 per CC	≥8
Note 1:	The application 8.1.2.3B.	ability of requi	rements fo	r different CA configurations and bandwidth combination sets	is defined in

Table 8.2.3.3.2-7: Minimum performance for multiple CA configurations with 5DL CCs (FRC)

Test	Aggregated Bandwidth (MHz) Total FDD CC TDD		(MHz)	Minimum performance requirement	UE		
number					Category		
			CC				
1	15+4×20	15+2×20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11		
2	2×15+3×20	2×15+20	2×20	As defined in Table 8.2.3.1.1-2 and Table 8.2.3.1.1-3 per CC	8, ≥11		
Note 1:	The applicabili	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in					
	8.1.2.3B.	•		-			

8.2.3.4 Minimum Requirement for Closed-loop spatial multiplexing performance 4Tx Antenna Port for dual connectivity

For dual connectivity the requirements are specified in Table 8.2.3.4-4, based on single carrier requirement specified in Table 8.2.3.4-2 and Table 8.2.3.4-3, with the addition of the parameters in Table 8.2.3.4-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with wideband and frequency selective precoding by using dual connectivity transmission.

Table 8.2.3.4-1: Test Parameters for Multi-Layer Spatial Multiplexing (FRC) for TDD-FDD dual connectivity

Parameter	•	Unit	Values
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	-6
	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	-	dВ	-3

N_{oc} at antenna port	dBm/15kHz	-98
Precoding granularity	PRB	6 for 1.4MHz, 4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, and 8 for 15MHz CCs and 20MHz CCs
PMI delay (Note 2)	ms	8 for FDD CC 10 or 11 for TDD CC
Reporting interval	ms	1 for FDD CC 1 or 4 for TDD CC (Note 3)
Reporting mode		PUSCH 1-2
CodeBookSubsetRestriction bitmap		00000000000000000000000000000000000000
PDSCH transmission mode		4
ACK/NACK transmission		Separate ACK/NACK feedbacks with PUCCH format 1b on the MCG and SCG
CSI feedback		Separate PUSCH feedbacks on the MCG and SCG
Time offset between MCG CC and SCG CC	μS	0 for UE under test supporting synchronous dual connectivity; 334 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 5)

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate

between 1ms and 4ms.

Note 4: The same PDSCH transmission mode is applied to each component carrier.

Note 5: As defined in TS36.300 [11].

Note 6: If the UE supports both SCG bearer and Split bearer, the SCG bearer is

configured.

Table 8.2.3.4-2: FDD single carrier performance for multiple dual connectivity configurations

			Propa- Correlation Reference va		value	
Bandwidth	Reference channel	OCNG pattern	gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.14-4 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.36
3MHz	R.14-5 FDD	OP. 1 FDD	EVA5	4x2 Low	70	9.5
5MHz	R.14-6 FDD	OP. 1 FDD	EVA5	4x2 Low	70	9.5
10 MHz	R.14 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.1
15MHz	R.14-7 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.1
20MHz	R.14-3 FDD	OP. 1 FDD	EVA5	4x2 Low	70	10.3

Table 8.2.3.4-3: TDD single carrier performance for multiple dual connectivity configurations

			Brons-	Correlation	Reference v	/alue
Bandwidth	Reference channel	OCNG pattern	Propa- gation condi- tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)

1.4MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10 MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP. 1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.3.4-4: Minimum performance Multi-Layer Spatial Multiplexing (FRC) for dual connectivity

Test num.	Bandwidth combination	combination Requirement			
1	2x20 MHz	As specified in Table 8.2.3.4-2 and Table 8.2.3.4-3 per CC	≥5		
Note 1: The OCNG pattern applies for each CC.					
	applicability of requirements for	or different dual connectvity configurations and	bandwidth		

8.2.4 LAA

8.2.4.1 Closed-loop spatial multiplexing performance 4Tx Antenna Port

8.2.4.1.1 FDD PCell (FDD single carrier)

The parameters specified in Table 8.2.4.1.1-1 are valid for FDD CC and LAA SCell(s) unless otherwise stated. And the additional parameters specified in Table 8.2.4.1.1-2 are valid for LAA SCell(s).

Table 8.2.4.1.1-1: Common Test Parameters

Parameter	Unit	Value
Inter-TTI Distance		1
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission (Note 1)		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM
Cyclic Prefix		Normal
Cell_ID		0
Cross carrier scheduling		Not configured

Note 1: For retransmission in partial subframes, the TB size should be kept the same as the initial transmission regardless of the initial transmission is performed in full subframes or partial subframes.

Table 8.2.4.1.1-2: Addtional Test Parameters for LAA SCell(s)

Parameter	Unit	Value
DMTC Periodicity	ms	80
dmtc-PeriodOffset-r12 ms80-r12		0
Discovery signal occasion duration	subframe	1
Power allocation of discovery signal		Same as power allocation of CRS within a transmission burst in the test

For CA with LAA SCell(s), the requirements are specified in Table 8.2.4.1.1-4, with the addition of the parameters in Table 8.2.4.1.1-1, Table 8.2.4.1.1-2, Table 8.2.4.1.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with frequency selective precoding for CA with LAA SCell(s).

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.4.1.1-3: Test Parameters for Dual-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Value
Devention of a series	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	3
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
Precoding granu	ılarity	PRB	4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs
PMI delay (Not	e 2)	ms	8
Reporting inte	rval	ms	1
Reporting mode			PUSCH 1-2
CodeBookSubsetRestriction			000000000000000000000000000000000000000
bitmap			0011111111111111110000000000000
			0000
CSI request field (Note 3)			'10'
PDSCH transmission			TM4
DL Burst transmission for LAA SCe			As specified in B.8
The number of subfr	st		{1,3,5,8}
Occupied OFDM symbols set in the last subframe			{6,9,12,14}
Random variable p o	defined in		0.5
timing error relative SCell to PCe		μs	0
Frequency offset of t SCell relative to		Hz	200

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Multiple CC-s under test are configured as the 1st set of serving cells by higher layers.

Note 4: ACK/NACK bits are transmitted using PUSCH with PUCCH format 3.

Note 5: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.4.1.1-4: Single carrier performance for PCell for multiple CA configurations

				Correlation	Reference	e value
Band- width	Reference channel	OCNG pattern	Propa- gation condi-tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.14-4 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.4
3MHz	R.14-5 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
5MHz	R.14-6 FDD	OP.1 FDD	EVA5	4x2 Low	70	9.5
10MHz	R.14 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
15MHz	R.14-7 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.1
20MHz	R.14-3 FDD	OP.1 FDD	EVA5	4x2 Low	70	10.3

Table 8.2.4.1.1-5: Single carrier performance for LAA SCell(s) for multiple CA configurations

						Reference va	lue
Band- width	Sub-test (Note 2)	Reference channel	OCNG pattern	Propa- gation condition	Correlation matrix and antenna config.	Fraction of norminal maximum throughput (%) (Note 1)	SNR (dB)
	1	R.1 FS3	OP.1 FS3	EVA5	4x2 Low	70	18.7
201411-	2	R.1 FS3	OP.1 FS3	EVA5	4x2 Low	70	18.6
20MHz	3	R.1 FS3	OP.1 FS3	EVA5	4x2 Low	70	18.9
	4	R.1 FS3	OP.1 FS3	EVA5	4x2 Low	70	19

Note 1: Fraction of nominal maximum throughput is calculated based on random transmission occasions of PDSCH.

Note 2: An UE is required to fulfill only one test of Sub-test 1-4 depending on UE capabilities of endingDwPTS and secondSlotStartingPosition. For an UE not supporting both endingDwPTS and secondSlotStartingPosition, it is required to fulfill Sub-test 1; For an UE not supporting endingDwPTS but supporting secondSlotStartingPosition, it is required to fulfill Sub-test 2; For an UE supporting endingDwPTS but not supporting secondSlotStartingPosition, it is required to fulfill Sub-test 3; and For an UE supporting both endingDwPTS and secondSlotStartingPosition, it is required to fulfill Sub-test 4.

Table 8.2.4.1.1-6: Minimum performance (FRC) based on single carrier performance for CA with LAA SCell(s)

Test	Aggregated Bandwidth (MHz)		dth (MHz)	Minimum performance requirement (Note 2)	UE
number	Total	PCell	LAA SCell		Category
1	2x20	20	20	As defined in Table 8.2.4.1.1-4 and Table 8.2.4.1.1-5	≥5

Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3C.

Note 2: Apply a per-CC requirement defined in 8.2.4.1.1-4 for PCell and apply a per-CC requirement defined in 8.2.4.1.1-5 for LAA SCell.

8.2.4.1.2 TDD PCell (TDD single carrier)

The parameters specified in Table 8.2.4.1.2-1 are valid for TDD CC and LAA SCell(s) unless otherwise stated. And the additional parameters specified in Table 8.2.4.1.2-2 are valid for LAA SCell(s).

Table 8.2.4.1.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value			
Uplink downlink configuration (Note 1)		1			
Special subframe configuration (Note 2)		4			
Cyclic prefix		Normal			
Cell ID		0			
Inter-TTI Distance		1			
Number of HARQ processes per component carrier	Processes	7			
Maximum number of HARQ transmission (Note 3)		4			
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM			
Cross carrier scheduling		Not configured			
Note 1: as specified in Table 4.2-2 in TS 36.211 [4]. Note 2: as specified in Table 4.2-1 in TS 36.211 [4]. Note 3: For retransmission in partial subframes, the TB size should be kept the same a the initial transmission regardless of the initial transmission is performed in full subframes or partial subframes.					

Table 8.2.4.1.2-2: Addtional Test Parameters for LAA SCell(s)

Parameter	Unit	Value
DMTC Periodicity	ms	80
dmtc-PeriodOffset-r12 ms80-r12		0
Discovery signal occasion duration	subframe	1
Power allocation of discovery signal		Same as power allocation of CRS within a transmission burst in the test

For CA with LAA SCell(s), the requirements are specified in Table 8.2.4.1.2-4, with the addition of the parameters in Table 8.2.4.1.2-1, Table 8.2.4.1.2-2, Table 8.2.4.1.2-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-two performance with frequency selective precoding for CA with LAA SCell(s).

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.2.4.1.2-3: Test Parameters for Dual-Layer Spatial Multiplexing (FRC)

Parameter	Parameter		Value
Danielink name	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
acac.	σ	dB	3
N_{oc} at antenna	port	dBm/15kHz	-98
Precoding granu	ılarity	PRB	4 for 3MHz and 5MHz CCs, 6 for 10MHz CCs, 8 for 15MHz and 20MHz CCs
PMI delay (Not	e 2)	ms	10 or 11
Reporting inte	rval	ms	1 or 4 (Note 3)
Reporting mo	de		PUSCH 1-2
CodeBookSubsetRe bitmap	CodeBookSubsetRestriction bitmap		00000000000000000000000000000000000000
CSI request field (Note 4)		'10'
PDSCH transmission			TM4
DL Burst transmission for LAA SCe	ell		As specified in B.8
The number of subfr	st		{1,3,5,8}
Occupied OFDM syr in the last subfr			{6,9,12,14}
Random variable <i>p</i> defined in B.8			0.5
timing error relative of LAA SCell to PCell		μs	0
Frequency offset of t SCell relative to		Hz	200

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms.

Note 4: Multiple CC-s under test are configured as the 1st set of serving cells by higher

Note 5: ACK/NACK bits are transmitted using PUSCH with PUCCH format 3.

Note 6: The same PDSCH transmission mode is applied to each component carrier.

Table 8.2.4.1.2-4: Single carrier performance for PCell for multiple CA configurations

				Correlation	Reference value	
Band- width	Reference channel	OCNG pattern	Propa- gation condi-tion	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)
1.4MHz	R.43-1 TDD	OP.1 TDD	EVA5	4x2 Low	70	11.0
3MHz	R.43-2 TDD	OP.1 TDD	EVA5	4x2 Low	70	9.8
5MHz	R.43-3 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.0
10MHz	R.43-4 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.5
15MHz	R.43-5 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.6
20MHz	R.43 TDD	OP.1 TDD	EVA5	4x2 Low	70	10.7

Table 8.2.4.1.2-5: Single carrier performance for LAA SCell for multiple CA configurations

					Correlation	Reference value	
Bandwidth	Sub-test (Note 2)	Reference channel	OCNG pattern	Propa- gation condition	matrix and antenna config.	Fraction of maximum throughput (%) (Note 1)	SNR (dB)
	1	R.1 FS3	OP.1 FS3	EVA5	4x2 Low	70	18.7
20MHz	2	R.1 FS3	OP.1 FS3	EVA5	4x2 Low	70	18.6
ZUIVIHZ	3	R.1 FS3	OP.1 FS3	EVA5	4x2 Low	70	18.9
	4	R.1 FS3	OP.1 FS3	EVA5	4x2 Low	70	19

Note 1: Fraction of nominal maximum throughput is calculated based on random transmission occasions of PDSCH.

Note 2: An UE is required to fulfill only one test of Sub-test 1-4 depending on UE capabilities of endingDwPTS and secondSlotStartingPosition. For an UE not supporting both endingDwPTS and secondSlotStartingPosition, it is required to fulfill Sub-test 1; For an UE not supporting endingDwPTS but supporting secondSlotStartingPosition, it is required to fulfill Sub-test 2; For an UE supporting endingDwPTS but not supporting secondSlotStartingPosition, it is required to fulfill Sub-test 3; and For an UE supporting both endingDwPTS and secondSlotStartingPosition, it is required to fulfill Sub-test 4.

Table 8.2.4.1.2-6: Minimum performance (FRC) based on single carrier performance for CA with LAA SCell(s)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement (Note 2)	UE			
numbe r	Total PCell LAA SCell				Category			
1	2x20	2x20 20 As defined in Table 8.2.4.1.2-4 and Table 8.2.4.1.2-5						
Note 1:	2x20 20 As defined in Table 8.2.4.1.2-4 and Table 8.2.4.1.2-5 ≥5 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3C.							
Note 2:	Apply a per 8.2.4.1.2-5			I in 8.2.4.1.2-4 for PCell and apply a per-CC requirement defin	ed in			

8.3 Demodulation of PDSCH (User-Specific Reference Symbols)

8.3.1 FDD

The parameters specified in Table 8.3.1-1 are valid for FDD unless otherwise stated.

Table 8.3.1-1: Common Test Parameters for User-specific Reference Symbols

Parameter	Unit	Value
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM
Number of OFDM symbols for PDCCH	OFDM symbols	2
Precoder update granularity		Frequency domain: 1 PRG for Transmission modes 9 and 10 Time domain: 1 ms
Note 1: Void. Note 2: Void.		

8.3.1.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.1-1 and 8.3.1.1-2, with the addition of the parameters in Table 8.3.1.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.1.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

parameter	parameter		Test 1, Test 1a	Test 2	Test 3	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	
	σ	dB	-3	-3	-3	
Beamforming mo	del		Annex B.4.1	Annex B.4.1	Annex B.4.1	
Cell-specific reference	ence			Antenna ports 0,1		
CSI reference sign			Antenna ports 15,,18	Antenna ports 15,,18	Antenna ports 15,, 18	
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	t	Subframes	5/2	5/2	5/2	
CSI reference sig configuration	nal		0	3	0	
Zero-power CSI- configuration I _{CSI-RS} / ZeroPowerCSI-I bitmap		Subframes / bitmap	3 / 000100000000000000	3 / 00010000000000000	3 / 00010000000000000	
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98	-98	-98	
Symbols for unus PRBs	ed		OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)	
Number of alloca resource blocks (No		PRB	50	50	50	
Simultaneous transmission			No	Yes (Note 3, 5)	No	
PDSCH transmiss mode			9	9	9	
Number of MBSI subframes	-N	Subframes	6 (Note 6)	NA	NA	

Note 1: $P_R = 1$.

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases.

Note 6: For FDD mode, 6 subframes (#1/2/3/6/7/8) are allocated as MBSFN subframes.

Table 8.3.1.1-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidt	Reference	OCNG	Propagation	gation Correlation Reference value		value	UE	UE DL
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category	Cat- egory
1	10 MHz QPSK 1/3	R.43-1 FDD	OP.1 FDD	EVA5	2x2 Low	70	-1.2	≥1	≥6
1a	10 MHz QPSK 1/3	R.43-2 FDD	OP.1 FDD	EVA5	2x2 Low	70	[-1.3]	≥1	≥6
3	10MHz 256QAM	R. 66 FDD	OP.1 FDD	EPA5	2x2 Low	70	24.3	11-12	≥11

Note 1: For UE that indicates support of *pdsch-CollisionHandling-r13*, test 1a will be run and test 1 will be skipped. Otherwise, test 1 will be run and test 1a will be skipped.

Table 8.3.1.1-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
2	10 MHz 64QAM 1/2	R.50 FDD	OP.1 FDD	EPA5	2x2 Low	70	21.9	≥2
Note 1:	The reference of	channel applie	s to both the i	input signal unde	er test and the inte	rfering signal.		

8.3.1.1A Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.1.1A-2, with the addition of the parameters in Table 8.3.1.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.1.1A-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.3.1.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

paramete	r	Unit	Cell 1	Cell 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referer	nce signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference s	signals		Antenna ports 15,,18	N/A
CSI-RS periodic subframe offset T_{CSI}	-RS / Δ CSI-RS	Subframes	5/2	N/A
CSI reference configuration			0	N/A
$N_{\it oc}$ at antenn	a port	dBm/15kH z	-98	N/A
DIP (Note	2)	dB	N/A	-1.73
BWChanne	l	MHz	10	10
Cyclic Pref	ïx		Normal	Normal
Cell Id			0	126
Number of contro symbols	I OFDM		2	2
PDSCH transmiss	ion mode		9	N/A
Beamforming ı	model		As specified in clause B.4.3 (Note 4, 5)	N/A
Interference n	nodel		N/A	As specified in clause B.5.4
Probability of occurrence of	Rank 1		N/A	70
transmission rank in interfering cells	Rank 2		N/A	30
Precoder update g	ranularity	PRB	50	6
PMI delay (No	ote 5)	Ms	8	N/A
Reporting into	erval	Ms	5	N/A
Reporting m	ode		PUCCH 1-1	N/A
CodeBookSubsetF bitmap	Restriction		0000000000000000 00000000000000000 00000	N/A
Symbols for unus	ed PRBs		OCNG (Note 6)	N/A
Simultaneous trar	smission		No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test	N/A
Physical channel reporting			PUSCH(Note 8)	N/A
cqi-pmi-Configura			5	N/A

Note 1: $P_B = 1$

Note 2: The respective received power spectral density of each interfering cell relative to N_{oc} ' is defined by its associated DIP value as specified in clause B.5.1.

Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.

Note 4:	The precoder in clause B.4.3 follows UE recommended PMI.
Note 5:	If the UE reports in an available uplink reporting instance at subrame SF#n based
	on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI
	cannot be applied at the eNB downlink before SF#(n+4).
Note 6:	These physical resource blocks are assigned to an arbitrary number of virtual UEs
	with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs
	shall be uncorrelated pseudo random data, which is QPSK modulated.
Note 7:	All cells are time-synchronous.
Note 8:	To avoid collisions between CQI reports and HARQ-ACK it is necessary to report
	both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in
	downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on
	PUSCH in uplink subframe SF#8 and #3.

Table 8.3.1.1A-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model

Test Number	Referenc e		NG tern		gation itions	Correlatio n Matrix	Reference V	Reference Value	
	Channel	Cell 1	Cell 2	Cell 1	Cell 2	and Antenna Configurat ion (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	у
1	R.48 FDD	OP.1 FDD	N/A	EVA5	EVA5	4x2 Low	70	-1.1	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

8.3.1.1B Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.1.1B-2, with the addition of parameters in Table 8.3.1.1B-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.1.1B-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.1.1B-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3	
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	-3 (Note 1)	-3 (Note 1)	
	σ	dB	-3	N/A	N/A	
	N_{oc1}	dBm/15kHz	-98 (Note 2)	N/A	N/A	
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A	N/A	
	N_{oc3}	dBm/15kHz	-93 (Note 4)	N/A	N/A	
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.3.1.1B-2	12	10	
BW _{Channel}		MHz	10	10	10	
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time Offset betwee	n Cells	μs	N/A	3	-1	
Frequency shift between	een Cells	Hz	N/A	300	-100	
Cell Id			0	1	126	
Cell-specific referenc	e signals		A			
CSI reference sig			Antenna ports 15,16	N/A	N/A	
CSI-RS periodicity subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	et s	Subframes	5/2	N/A	N/A	
CSI reference signoration			8	N/A	N/A	
Zero-power CSI- configuration I _{CSI-RS} / ZeroPowe bitmap		Subframes / bitmap	3 / 00100000000000 00	N/A	N/A	
ABS pattern (No	te 5)		N/A	11000000 11000000 11000000 11000000 11000000	1100000 1100000 1100000 1100000 1100000	
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000 1000000	N/A	N/A	
CSI Subframe Sets	C _{CSI,0}		11000000 11000000 11000000 11000000 11000000	N/A	N/A	
(Note7)	Ccsi,1		00111111 00111111 00111111 00111111 00111111	N/A	N/A	
Number of control symbols	OFDM		2	Note 8	Note 8	
PDSCH transmissio	n mode		TM9-1layer	Note 9	Note 9	
Precoding granul			Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A	
Beamforming mo	odel		Annex B.4.1	N/A	N/A	
Cyclic prefix		Ĺ	Normal	Normal	Normal	

Reference Value

UE

Note 1:	$P_B = 1$.
Note 2:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 4:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 5:	ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
Note 6:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 7:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 9:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.
Note 10:	If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).
Note 11:	
Note 12:	
Note 13:	The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Table 8.3.1.1B-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) - Non-MBSFN ABS

Propagation

Correlation

Number	Channel				Cond	litions (N	lote1)	Matrix and			Cate	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory	
1	R.51 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD		EVA5		2x2 Low	70	7.8	≥2	
Note 1: Note 2:		ion conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. on matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.										

Note 3: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

OCNG Pattern

Reference

Test

8.3.1.1C Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.1.1C-2, with the addition of the parameters in Table 8.3.1.1C-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7, 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In 8.3.1.1C-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1C-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM9 interference model

Paran	neter	Unit	Cell 1	Cell 2	Cell 3
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power alloca	ition $ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port		dBm/15kHz		-98	
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34
BWchannel		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Number of control OFI	DM symbols		3	3	3
CFI indicated in PCFIC	CH		3	3	3
PDSCH transmission i	mode		9	9	9
Interference model			N/A	As specified in clause B.6.4	As specified in clause B.6.4
Precoding			Random wideband precoding per TTI	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signals			Antenna ports 15, 16, 17, 18	Antenna ports 15, 16	Antenna ports 15, 16
CSI-RS periodicity and TcsI-RS / \(\Delta \color= \text{RS} \)	d subframe offset	Subframes	10 / 1	10 / 1	10 / 1
CSI reference signal c	onfiguration		5	6	7
Zero-power CSI-RS co I _{CSI-RS} /ZeroPowerCSI-	Zero-power CSI-RS configuration Icsi-RS /ZeroPowerCSI-RS bitmap		6 / 10000000000 00000	6 / 010000000000 0000	6 / 00100000000 00000
Time offset to cell 1		us	N/A	2	3
Frequency offset to cell 1		Hz	N/A	200	300
MBSFN	_		Not configured	Not configured	Not configured
NeighCellsInfo- p	-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
	ransmissionModeList r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1: $P_B = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.1.1C-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM9 interference model

Test Num	Referenc e	ОС	NG Patt	tern		opagat onditio				trix and guration	Reference	e Value	UE Categ
ber	Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	ory
1	R.69 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	4x2 Low	2x2 Low	2x2 Low	85	18.5	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

8.3.1.1D Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with CRS interference model

The requirements are specified in Table 8.3.1.1D-2, with the addition of the parameters in Table 8.3.1.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by the CRS of the interfering cell, applying the CRS interference model defined in clause B.6.5. In 8.3.1.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1D-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with CRS interference model

Parame	eter	Unit	Cell 1	Cell 2	Cell 3		
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0		
Downlink power allocate	on $ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0		
	σ	dB	-3	-3	-3		
Cell-specific reference	signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
N_{oc} at antenna port		dBm/15kHz	-98				
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34		
BW _{Channel}		MHz	10	10	10		
Cyclic Prefix			Normal	Normal	Normal		
Cell Id			0	1	6		
Number of control OFD	M symbols		3	3	3		
CFI indicated in PCFIC	Н		3	3	3		
PDSCH transmission m	ode		8	N/A	N/A		
Interference model			N/A	As specified in clause B.6.5	As specified in clause B.6.5		
Precoding			Random wideband precoding per TTI	N/A	N/A		
Time offset to cell 1		us	N/A	2	3		
Frequency offset to cell 1		Hz	N/A	200	300		
MBSFN			Not configured	Not configured	Not configured		
NeighCellsInfo- r12	aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}		
(Note 3) tra	nsmissionModeList 12		N/A	{2,3,4,8,9}	{2,3,4,8,9}		

Note 1: $P_{R} = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.1.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with CRS interference model

Test Number	Reference Channel	OCNG Pattern				opagat onditio		Correlation Matrix and	Reference Value		UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.71 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	14.3	≥2

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.3.1.1E Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM3 interference model

The requirements are specified in Table 8.3.1.1E-2, with the addition of the parameters in Table 8.3.1.1E-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 3 interference model defined in clause B.6.2. In 8.3.1.1E-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1E-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM3 interference model

$\begin{array}{c} \rho_{A} \\ \rho_{B} \\ \hline \sigma \\ \\ \hline \end{array}$ Cell-specific reference signals N_{oc} at antenna port \hat{E}_{s}/N_{oc}	В	dB dB dB dB MHz	0 (Note 1) -3 Antenna ports 0,1	-3 -3 0 Antenna ports 0,1 -98	-3 -3 0 Antenna ports 0,1
allocation ρ_B σ Cell-specific reference signals ρ_{oc} at antenna port ρ_{oc}		dB dBm/15kHz dB	-3 Antenna ports 0,1	0 Antenna ports 0,1 -98	0 Antenna ports
Cell-specific reference signals N_{oc} at antenna port \hat{E}_s/N_{oc}		dBm/15kHz	Antenna ports 0,1	Antenna ports 0,1 -98	Antenna ports
N_{oc} at antenna port \hat{E}_s/N_{oc}		dB	0,1	0,1 -98	•
\hat{E}_s/N_{oc}		dB	N/A		
		_	N/A		
		NALL-	1	3.28	0.74
BWchannel		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Number of control OFDM symb	bols		3	3	3
CFI indicated in PCFICH			3	Random from {1,2,3}	Random from {1,2,3}
PDSCH transmission mode			8	3	3
Interference model			N/A	As specified in clause B.6.2	As specified in clause B.6.2
Precoding			Random wideband precoding per TTI	As specified in clause B.6.2	As specified in clause B.6.2
Time offset to cell 1		us	N/A	2	3
Frequency offset to cell 1		Hz	N/A	200	300
MBSFN			Not configured	Not configured	Not configured
NeighCellsInfo- r12 p-aList-r1	eighCellsInfo- p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4) transmiss -r12	sionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1: $P_{R} = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.1.1E-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM3 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference	Reference Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.70 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	11.5	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.3.1.1F Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM10 serving cell configuration and TM9 interference model

The requirements are specified in Table 8.3.1.1F-2, with the addition of the parameters in Table 8.3.1.1F-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the

serving cell when the PDSCH transmission configured with TM10 in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.6.3. The NAICS network assistance is provided when the serving cell TM10 is configured with QCL-type A and PCID based DM-RS scrambling. The neighbouring cell has transmission mode TM9 and NeighCellsInfo-r12 for interfering cell indicates presence of TM9. In 8.3.1.1F-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.1.1F-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM10 serving cell configuration and TM9 interference model

Parameter			Unit	Cell 1	Cell 2	Cell 3			
	pocation $ ho_{\scriptscriptstyle A} = ho_{\scriptscriptstyle B}$		dB	0	0	0			
Downlink power allo			dB	0 (Note 1)	0	0			
		σ	dB	-3	-3	-3			
Cell-specific reference signals				Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1			
N_{oc} at antenna port			dBm/15kHz	-98					
\hat{E}_s/N_{oc}			dB	N/A	3.34				
BWchannel				10	10				
Cyclic Prefix				Normal	Normal	Normal			
Cell Id				0	1	6			
Number of control O	FDM sym	bols		3	3	3			
CFI indicated in PCFICH				3	3	3			
PDSCH transmission mode				10	9	9			
Interference model				N/A As specified in clause B.6.4		As specified in clause B.6.4			
Precoding				Random wideband precoding per TTI	As specified in clause B.6.4	As specified in clause B.6.4			
CSI reference signals				Antenna ports Antenna 15, 16, 17, 18 15, 1		Antenna ports 15, 16			
CSI-RS periodicity and subframe offset Tcsi-Rs / ∆csi-Rs			Subframes	10 / 1	10 / 1	10 / 1			
CSI reference signal configuration				5	6	7			
Zero-power CSI-RS configuration Icsi-RS /ZeroPowerCSI-RS bitmap			Subframes / bitmap	6 / 1000000000 00000	6 / 01000000000 0000	6 / 00100000000 00000			
Time offset to cell 1			us	N/A	2	3			
Frequency offset to cell 1			Hz	N/A	200	300			
MBSFN				Not configured	Not configured	Not configured			
NeighCellsInfo- p-aLi		12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}			
(Note 4)	transmis	sionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}			

Note 1: $P_B = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.1.1F-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM10 serving cell configuration and TM9 interference model

Test Number	Referenc e Channel	OCNG Pattern			Propagation Conditions			Correlation Matrix and Antenna Configuration		Reference Value		UE Cate gory	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	
1	R.69 FDD	OP. 1 FD D	N/A	N/A	EP A5	EP A5	EP A5	4x2 Low	2x2 Low	2x2 Low	85	18.2	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

8.3.1.1G Single-layer Spatial Multiplexing (CRS assistance information is configured)

The requirements are specified in Table 8.3.1.1G-2, with the addition of parameters in Table 8.3.1.1G-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell with CRS assistance information. In Table 8.3.1.1G-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1, Cell2 and Cell 3 is according to Annex C.3.2. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.1.1G-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports)

Parameter	•	Unit	Cell 1	Cell 2	Cell 3		
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)		
	σ	dB	-3	-3	-3		
N _{oc} at antenna port	N_{oc} at antenna port		-98	N/A	N/A		
Ê _s /N _{oc}		dB	Reference Value in Table 8.3.1.1G-2	10.45	4.6		
BW _{Channel}		MHz	10	10	10		
Subframe Configuration	on		Non-MBSFN	Non-MBSFN	Non-MBSFN		
Time Offset to Cell 1		μs	N/A	-1			
Frequency shift to Ce	II 1	Hz	Hz N/A		-100		
Cell Id			0	1	128		
Cell-specific reference	e signals		Antenna ports 0,1				
CSI reference signals			Antenna ports 15,16 N/A		N/A		
CSI-RS periodicity an offset Tcsi-Rs / ∆csi-Rs	d subframe	Subframes	5/2	N/A	N/A		
CSI reference signal configuration			8	N/A	N/A		
Zero-power CSI-RS configuration IcsI-RS / ZeroPowe bitmap		Subframes / bitmap	3 / 0010000000000 000	N/A	N/A		
Number of control OF symbols	DM		2	2	2		
PDSCH transmission	mode		TM9-1layer	N/A	N/A		
Precoding granularity			Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A		
Beamforming model			Annex B.4.1	N/A	N/A		
Interference model			N/A	As specified in clause B.5.4	As specified in clause B.5.4		
Probability of occurrer transmission in interfe		%	N/A	20	20		
Probability of occurrence of	Rank 1	%	N/A	80	80		
transmission rank in interfering cells	Rank 2	%	N/A	20	20		
Cyclic prefix			Normal	Normal	Normal		
Note 1: D = 1							

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.

Note 4: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Note 5: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Table 8.3.1.1G-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports)

			OCNG Pattern			opagations (N		Correlation Matrix and	Reference Value		UE
Test Number	Reference Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	Cate gory
1	R.51-1 FDD	OP.1 FDD	N/A	N/A		EVA5		2x2 Low	70	11.6	≥2

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

8.3.1.1H Single-layer Spatial Multiplexing (With Enhanced DMRS table configured)

For single-layer transmission on antenna port 7, 8, 11 or 13 upon detection of a PDCCH with DCI format 2C, the requirement is specified in Table 8.3.1.1H-2, with the addition of the parameters in Table 8.3.1.1H-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of the test is to verify rank-1 performance on antenna port 11 with a simultaneous transmission on the antenna port 7, 8 or 13 with DMRS enhancement table and 4 orthogonal DMRS ports (dmrs-Enhancements-r13 UE-EUTRA-Capability [7]).

Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to $\mathbb{E}_{\mathfrak{s}}/N_{\mathfrak{o}\mathfrak{o}}$ of cell 1.

Table 8.3.1.1H-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations with Enhanced DMRS table

parameter		Unit	Test 1				
Daniel Landin	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)				
	σ	dB	-3				
Beamforming model			Annex B.4.1A				
Cell-specific reference sig	gnals		Antenna ports 0,1				
CSI reference signals	3		Antenna ports 15,,18				
CSI-RS periodicity and sub- offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	frame	Subframes	5/2				
CSI reference signal configuration			3				
Zero-power CSI-RS configuration I _{CSI-RS} / ZeroPowerCSI-RS bitm	ар	Subframes / bitmap	3 / 0001000000000000				
$N_{\it oc}$ at antenna port		dBm/15kHz	-98				
Symbols for unused PR	Bs		OCNG (Note 4)				
Number of allocated reso blocks (Note 2)	urce	PRB	50				
Simultaneous transmiss	ion		Yes (Note 3, 5)				
dmrs-Enhancements-r			Enable				
PDSCH transmission m	ode		9				
Note 1: $P_B = 1$.							
Note 2: The modulation symbols of the signal under test are mapped onto							

Note 2: The modulation symbols of the signal under test are mapped onto

antenna port 11.

Note 3: Modulation symbols of an interference signal are random mapped onto one antenna port among antenna port 7, 8 and 13. The upadate granularity for randomized mapping antenna port is 1 PRG

in frequency domain and 1ms in time domain.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted

over the OCNG PDSCHs shall be uncorrelated pseudo random data,

which is QPSK modulated.

Note 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 with OCC =4.

Table 8.3.1.1H-2: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations with Enhanced DMRS table

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	Reference value	
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 64QAM 1/2	R.50 FDD	OP.1 FDD	EPA5	2x2 Low	70	21.9	≥2
Note 1:	The reference	channel applie	es to both the	input signal unde	er test and the inte	erfering signal.		

8.3.1.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.1.2-2, with the addition of the parameters in Table 8.3.1.2-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of

these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

Table 8.3.1.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

meter	Unit		st 1		
		Cell 1	Cell 2		
$ ho_{\scriptscriptstyle A}$	dB	0	0		
$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0		
σ	dB	-3	-3		
PDSCH_RA	dB	4	NA		
PDSCH_RB	dB	4	NA		
		Antenna ports 0 and 1	Antenna ports 0 and 1		
II ID		0	126		
ence signals		Antenna ports 15,16	NA		
ning model		Annex B.4.2	NA		
CSI-RS periodicity and subframe offset				5/2	NA
CSI reference signal configuration		8	NA		
juration _{I-RS} / /erCSI-RS	Subframes / bitmap	3 / 00100000000000000	NA		
ntenna port	dBm/15kHz	-98	-98		
		Reference Value in Table 8.3.1.2-2	7.25dB		
RBs		OCNG (Note 2)	NA		
ocks (Note 2)	PRB	50	NA		
mission		No	NA		
		9	Blanked		
	PDSCH_RA PDSCH_RB Fic reference Inals Fill ID Fince signals Finiodicity and Fine offset I ΔCSI-RS Fine CSI-RS Fi	Φ _B dB σ dB PDSCH_RA dB PDSCH_RB dB PDSCH_RB dB PDSCH_RB dB PDSCH_RB dB PDSCH_RB dB PRID dB PRB dB <td>Φ_B dB 0 (Note 1) σ dB -3 PDSCH_RA dB 4 PDSCH_RB dB 4 Antenna ports 0 and 1 1 Antenna ports 15,16 Annex B.4.2 Pance signal puration ver CSI-RS 8 Perce signal puration ver CSI-RS Subframes / bitmap 3 / 001000000000000000000000000000000000</td>	Φ _B dB 0 (Note 1) σ dB -3 PDSCH_RA dB 4 PDSCH_RB dB 4 Antenna ports 0 and 1 1 Antenna ports 15,16 Annex B.4.2 Pance signal puration ver CSI-RS 8 Perce signal puration ver CSI-RS Subframes / bitmap 3 / 001000000000000000000000000000000000		

Note 1: $P_B = 1$

Note 2:

2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.2-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test number	Bandwidth and MCS	Reference Channel		OCNG Propagation Pattern Condition		Correlation Reference value Matrix and		value	UE Categ	
			Cell1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	ory
1	10 MHz 16QAM 1/2	R.51 FDD	OP.1 FDD	N/A	ETU5	ETU5	2x2 Low	70	14.2	≥2

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

Note 3: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1.

Enhanced Performance Requirement Type C - Dual-Layer Spatial 8.3.1.2A Multiplexing

The requirements are specified in Table 8.3.1.2A-2, with the addition of the parameters in Table 8.3.1.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of this test is to verify rank two performance for full RB allocation upon antenna ports 7 and 8.

Table 8.3.1.2A-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-**RS** configurations

parameter		Unit	Test 1
Downlink nower	$\rho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Cell-specific reference signals	ence		Antenna ports 0 and 1
CSI reference sig	nals		Antenna ports 15,16
Beamforming mo	del		Annex B.4.2
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-R}}$	et	Subframes	5/2
CSI reference sig configuration	gnal		8
Zero-power CSI- configuration I _{CSI-RS} / ZeroPowerCSI- bitmap		Subframes / bitmap	3 / 00100000000000000
N_{oc} at antenna $ m _{l}$	oort	dBm/15kHz	-98
Symbols for unus PRBs	sed		OCNG (Note 2)
Number of alloca resource blocks (N		PRB	50
Simultaneous transmission	Simultaneous transmission		No
PDSCH transmis mode	sion		9
Note 1: $P_R = 1$			

Note 2: These physical resource blocks are assigned to an

arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random

data, which is QPSK modulated.

Table 8.3.1.2A-2: Enhanced Performance Requirement Type C for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM 1/2	R.51 FDD	OP.1 FDD	EPA5	2x2 Medium	70	17.4	≥2

8.3.1.3 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

8.3.1.3.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.1.3.1-3, with the additional parameters in Table 8.3.1.3.1-1 and Table 8.3.1.3.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6], configured according to Table 8.3.1.3.1-2. In Tables 8.3.1.3.1-1 and 8.3.1.3.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2 (TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.1.3.1-1: Test Parameters for quasi co-location type B: same Cell ID

Paramete	r	Unit	TP 1	TP 2	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	
	σ	dB	-3	-3	
Cell-specific referer	Cell-specific reference signals		Antenna ports 0,1	(Note 2)	
CSI-RS 0 antenr	na ports		NA	Port {15,16}	
qcl-CSI-RS-Configl CSI-RS 0 period subframe offset Tcsi	icity and I-RS / ∆csI-RS	Subframes	NA	5/2	
qcl-CSI-RS-Configl CSI-RS 0 config	uration		NA	8	
csi-RS-ConfigZPId- power CSI-RS 0 co Icsi-RS / ZeroPower CSI-R	nfiguration		NA	2/ 00000100000000000	
$N_{\it oc}$ at antenna port		dBm/15kH z	-98	-98	
\widehat{E}_s/N_{oc}	\widehat{E}_s/N_{oc}		Reference point in Table 8.3.1.3.1-3	Reference point in Table 8.3.1.3.1-3	
BW _{Channe}	BW _{Channel}		10	10	
Cyclic Pref	ix		Normal	Normal	
Cell Id			0	0	
Number of contro symbols	ol OFDM		2	2	
PDSCH transmiss	ion mode		Blanked	10	
Number of alloca	ted PRB	PRB	NA	50	
qcl-Operation, PE Mapping and Qu Location Indic	ıasi-Co-		Туре	B, '00'	
Time offset between	een TPs	μs	NA	Reference point in Table 8.3.1.3.1-3	
Frequency error be	tween TPs	Hz	NA	0	
Beamforming I	Beamforming model		NA	Port 7 as specified in clause B.4.1	
Symbols for unus	ed PRBs		NA	OCNG (Note 3)	

Note 1: $P_B = 1$

Noet 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.3.1-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	DL transmission hypothesis for each PQI Set		
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH

Table 8.3.1.3.1-3: Minimum performance for quasi co-location type B: same Cell ID

Test Number	Reference Channel		CN tern	Time offset between	Propag Cond (No	itions	Correlation Matrix and Antenna	Reference \	/alue	UE Category
		TP 1	TP 2	TPs (μs)	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.52 FDD	NA	OP.1 FDD	2	EPA5	EPA5	2x2 Low	70	12.1	≥2
2	R.52 FDD	NA	OP.1 FDD	-0.5	EPA5	EPA5	2x2 Low	70	12.6	≥2

Note 1: The propagation conditions for TP 1 and TP 2 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for TP 1 and TP 2.

Note 3: SNR corresponds to \hat{E}_s/N_{ac} of TP 2 as defined in clause 8.1.1.

8.3.1.3.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.1.3.2-3, with the additional parameters in Tables 8.3.1.3.2-1 and 8.3.1.3.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. In Tables 8.3.1.3.2-1 and 8.3.1.3.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.1.3.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.1.3.2-1: Test Parameters for timing offset compensation with DPS transmission

paramete	r	Unit	TP 1	TP 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

Beamforming model		As specified in clause B.4.1	As specified in clause B.4.1
Cell-specific reference signals		Antenna ports 0,1	(Note 2)
CSI reference signals 0		Antenna ports {15,16}	N/A
CSI-RS 0 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	5/2	N/A
CSI reference signal 0 configuration		0	N/A
CSI reference signals 1		N/A	Antenna ports {15,16}
CSI-RS 1 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5/2
CSI reference signal 1 configuration		N/A	8
Zero-power CSI-RS 0 configuration I _{CSI-RS} / ZeroPower CSI-RS bitmap	Subframes /bitmap	2/ 001000000000000000	N/A
Zero-power CSI-RS1 configuration lcsi-RS / ZeroPower CSI-RS bitmaps	Subframes /bitmap	N/A	2/ 00000100000000000
\widehat{E}_s/N_{oc}	dB	Reference Value in Table 8.3.1.3.2-3	Reference Value in Table 8.3.1.3.2-3
$N_{\it oc}$ at antenna port	dBm/15kH z	-98	-98
BWchannel	MHz	10	10
Cyclic Prefix		Normal	Normal
Cell Id		0	0
Number of control OFDM symbols		2	2
Timing offset between TPs		N/A	Reference Value in Table 8.3.1.3.2-3
Frequency offset between TPs	Hz	N/A	0
Number of allocated resource blocks	PRB	50	50
PDSCH transmission mode		10	10
Probability of occurrence of PDSCH transmission(Note 3)	%	30	70
Symbols for unused PRBs		OCNG (Note 4)	OCNG (Note 4)

Note 1: $P_{p} = 1$

Note 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: PDSCH transmission from TPs shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 3:

Table 8.3.1.3.2-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	Parameters in each PQI set					
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2			
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked			
PQI set 3	CSI-RS 1	Blanked	PDSCH				

Table 8.3.1.3.2-3: Performance Requirements for timing offset compensation with DPS transmission

Test Number	Timing offset(us)	Reference Channel		NG tern		gation litions	Correlation Reference Value Matrix and		/alue	UE Category	
			TP 1	TP 2	TP 1	TP 2	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)		
1	2	R.53 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	70	12.2	≥2	
2	-0.5	R.53 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	70	12.5	≥2	
Note 4:	Note 1: The propagation conditions for TP 1and TP 2 are statistically independent.										
Note 1: Note 2:						,	for each of TP 1 and	TP 2.			

8.3.1.3.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

SNR corresponds to E_s/N_{ac} of both TP 1 and TP 2 as defined in clause 8.1.1.

The requirements are specified in Table 8.3.1.3.3-2, with the additional parameters in Table 8.3.1.3.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. In Table 8.3.1.3.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.1.3.3-1: Test Parameters for quasi co-location type B with different Cell ID and Colliding CRS

paramete	r	Unit	TP 1	TP 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

Beamforming model		N/A	As specified in clause B.4.2	
Cell-specific reference signals		Antenna ports 0,1	Antenna ports 0,1	
CSI reference signals 0		N/A	Antenna ports {15,16}	
CSI-RS 0 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5/2	
CSI reference signal 0 configuration		N/A	0	
Zero-power CSI-RS 0 configuration I _{CSI-RS} / ZeroPower CSI-RS bitmap	Subframes /bitmap	N/A	2/ 00100000000000000	
\hat{E}_s/N_{oc}	dB	Reference point in Table 8.3.1.3.3-2 + 4dB	Reference Value in Table 8.3.1.3.3-2	
$N_{\it oc}$ at antenna port	dBm/15kH z	-98	-98	
BWChannel	MHz	10	10	
Cyclic Prefix		Normal	Normal	
Cell Id		0	126	
Number of control OFDM symbols		1	2	
Timing offset between TPs	us	N/A	0	
Frequency offset between TPs	Hz	N/A	200	
qcl-Operation, PDSCH RE Mapping and Quasi-Co- Location Indicator'		Type B, '00'		
PDSCH transmission mode		Blank	10	
Number of allocated resource block		N/A	50	
Symbols for unused PRBs		N/A	OCNG(Note2)	

Note 1: $P_B = 1$

These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs Note 2: shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.3.3-2: Performance Requirements for quasi co-location type B with different Cell ID and **Colliding CRS**

Test Number	Reference Channel		NG tern	Propagation Conditions (Note1)		Correlation Matrix and Antenna	Reference	UE Category	
		TP 1	TP 2	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.54 FDD	N/A	OP.1 FDD	EPA5	ETU5	2x2 Low	70	14.4	≥2

Note 1:

The propagation conditions for TP.1 and TP.2 are statistically independent.

Correlation matrix and antenna configuration parameters apply for each of TP.1 and TP.2. Note 2:

SNR corresponds to \hat{E}_{s}/N_{oc} of TP.2 as defined in clause 8.1.1. Note 3:

8.3.1.3.4 Minimum requirement with Different Cell ID and non-colliding CRS (with single NZP CSI-RS resource and CRS assistance information is configured)

The requirements are specified in Table 8.3.1.3.4-3, with the additional parameters in Table 8.3.1.3.4-1 and Table 8.3.1.3.4-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where three transmission points have different Cell ID and non-colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference and time difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. Further, the test verifies that the UE, configured with the CRS assistance information [7], can mitigate interference from CRS for demodulation. The CRS assistance information [7] includes TP 3. In Table 8.3.1.3.4-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, transmission point 2 (TP 2) transmits PDSCH with different Cell ID, and Transmission point 3 (TP 3) is the aggressor transmission point. The downlink physical channel setup for TP 1 is according to Table C.3.4-1, for TP 2 is according to Table C.3.4-2, and for TP 3 is according to Annex C.3.2.

Table 8.3.1.3.4-1: Test Parameters for quasi co-location type B with different Cell ID and non-Colliding CRS when CRS assistance information is configured

paramete	er	Unit	TP 1	TP 2	TP 3	
Dayslink nower	$\rho_{\scriptscriptstyle A}$	dB	0	0	0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0	
	σ	dB	-3	-3	-3	
Beamforming mode	el		N/A	Port 7 as specified in clause B.4.1	N/A	
Cell-specific referer	nce signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
CSI reference signa			N/A	Antenna ports {15,16}	N/A	
CSI-RS 0 periodicity subframe offset Tcs	$_{ ext{SI-RS}}$ / $\Delta_{ ext{CSI-RS}}$	Subframes	N/A	5/2	N/A	
CSI reference signal configuration			N/A	0	N/A	
Zero-power CSI-RS configuration I _{CSI-RS} / ZeroPower CSI-RS		Subframes /bitmap	N/A	2/ 001000000000000000	N/A	
\hat{E}_s/N_{oc}		dB	10.45	Reference Value in Table 8.3.1.3.4-3	8.45	
$N_{{\scriptscriptstyle oc}}$ at antenna por	t	dBm/15kH z	-98	-98	N/A	
BW _{Channel}		MHz	10	10	10	
Cyclic Prefix			Normal	Normal	Normal	
Cell Id	Cell Id		0 1		128	
Number of control C symbols	OFDM		1	2	2	
Timing offset to TP	1	us	N/A -0.5		3	
Frequency offset to		Hz	N/A	200	-100	
qcl-Operation, PDS Mapping and Quasi Location Indicator'			Туре	B, '00'	N/A	
PDSCH transmission	on mode		Blank	10	9	
Number of allocated block	d resource		N/A	50	N/A	
Symbols for unused	l PRBs		N/A	OCNG(Note2)	N/A	
Interference model			N/A	N/A	As specified in clause B.5.4	
Probability of occurr transmission in inte cells		%	N/A	N/A	20	
Probability of occurrence of	Rank 1	%	N/A	N/A	80	
transmission rank in interfering cells	Rank 2	%	N/A	N/A	20	

Note 1: $P_B = 1$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.1.3.4-2: Configurations of PQI and DL transmission hypothesis for each PQI set

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PQI set index	Parameter	hypoth	smission lesis for PQI Set	
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH

Table 8.3.1.3.4-3: Performance Requirements for quasi co-location type B with different Cell ID and non-Colliding CRS when CRS assistance information is configured

	Refere	OCI	NG Patte	rn	Propagation Conditions (Note1)		Correlation Reference Value		/alue	UE	
Test Number	nce Chann el	TP 1	TP 2	TP3	TP 1	TP 2	TP3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	Cate gory
1	R.52-1 FDD	N/A	OP.1 FDD	N/A	EVA5	EVA5	EVA5	2x2 Low	70	10.8	≥2

Note 1: The propagation conditions for TP.1, TP.2 and TP.3 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of TP.1, TP.2 and TP.3.

SNR corresponds to \hat{E}_s/N_{oc} of TP.2 as defined in clause 8.1.1. Note 3:

Minimum requirements with different Cell ID and non-colliding CRS (with multiple 8.3.1.3.5 NZP CSI-RS resources and CRS assistance information is configured)

The requirements are specified in Table 8.3.1.3.5-3, with the additional parameters in Tables 8.3.1.3.5-1 and 8.3.1.3.5-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where three transmission points have different Cell ID and non-colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference and timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. Further, the test verifies that the UE, configured with the CRS assistance information [7], can mitigate interference from CRS for demodulation. The CRS assistance information [7] includes TP 3. In Tables 8.3.1.3.5-1 and 8.3.1.3.5-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, Transmission point 2 (TP 2) has different Cell ID as TP 1, and Transmission point 3 (TP 3) is the aggressor transmission point. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between TP 1 and TP 2 with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.1.3.5-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1, for TP 2 is according to Table C.3.4-2, and for TP 3 is according to Annex C.3.2.

Table 8.3.1.3.5-1: Test Parameters DPS transmission with CRS assistance information

parameter		Unit	TP 1	TP 2	TP 3
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3
Beamforming mo	Beamforming model		As specified in clause B.4.1	As specified in clause B.4.1	N/A
Cell-specific refe	erence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
CSI reference si	gnals 0		Antenna ports {15,16}	N/A	N/A
CSI-RS 0 period subframe offset	$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	5/2	N/A	N/A
CSI reference significant configuration	gnal 0		0	N/A	N/A
CSI reference sign	gnals 1		N/A	Antenna ports {15,16}	N/A
CSI-RS 1 period subframe offset	$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5/2	N/A
CSI reference significant configuration	•		N/A	8	N/A
Zero-power CSI- configuration ICSI-RS / ZeroPower CSI-		Subframes /bitmap	2/ 001000000000000000	N/A	N/A
Zero-power CSI-RS1 configuration I _{CSI-RS} / Zero-Power CSI-RS bitmaps		Subframes /bitmap	N/A	2/ 0000010000000000	N/A
	\widehat{E}_{s}/N_{oc} (Note 2)		Reference Value in Table 8.3.1.3.5-3	Reference Value in Table 8.3.1.3.5-3	8.45
$N_{\it oc}$ at antenna port		dBm/15kH z	-98	-98	N/A
BW _{Channel}			10	10	10
Cyclic Prefix	Cyclic Prefix		Normal	Normal	Normal
Cell Id			0	1	128
Number of contro symbols	ol OFDM		2	2	2
Timing offset to	ΓP 1		N/A	-0.5	3
Frequency offset	t to TP 1	Hz	N/A	200	-100
Number of allocated blocks	ated resource	PRB	50	50	N/A
PDSCH transmis	ssion mode		10	10	9
Probability of occ PDSCH transmis		%	30	70	N/A
Symbols for unu	•		OCNG (Note 4)	OCNG (Note 4)	N/A
Interference mod	del		N/A	N/A	As specified in clause B.5.4
Probability of occurrence of transmission in interference cells		%	N/A	N/A	20
Probability of occurrence of transmission	Rank 1	%	N/A	N/A	80
rank in interfering cells	Rank 2	%	N/A	N/A	20

Note 1: $P_B = 1$

Note 2: \hat{E}_s/N_{oc} of TP1 is set the same as that of TP2.

Note 3: PDSCH transmission from TP 1 and TP 2 shall be randomly determined independently for each subframe.

Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per

virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data,

which is QPSK modulated.

Table 8.3.1.3.5-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	DL transmission hypothesis for each PQI Set		
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked
PQI set 1	CSI-RS 1	ZP CSI-RS 1	Blanked	PDSCH

Table 8.3.1.3.5-3: Performance Requirements DPS transmission with CRS assistance information

	Refere	oci	NG Patte	rn	Propagation Conditions (Note1)		Correlation	Correlation Reference Value			
Test Number	nce Chann el	TP 1	TP 2	TP3	TP 1	TP 2	TP3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	UE Cate gory
1	R.52-1 FDD	OP.1 FDD	OP.1 FDD	N/A	EVA5	EVA5	EVA5	2x2 Low	70	10.7	≥2

Note 1: The propagation conditions for TP.1, TP.2 and TP.3 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of TP.1, TP.2 and TP.3.

Note 3: SNR corresponds to \hat{E}_s/N_{oc} of both TP.1 and TP.2 as defined in clause 8.1.1.

8.3.2 TDD

The parameters specified in Table 8.3.2-1 are valid for TDD unless otherwise stated.

Table 8.3.2-1: Common Test Parameters for User-specific Reference Symbols

Parameter	Unit	Value					
Uplink downlink configuration (Note 1)		1					
Special subframe configuration (Note 2)		4					
Cyclic prefix		Normal					
Cell ID		0					
Inter-TTI Distance		1					
Number of HARQ processes	Processes	7					
Maximum number of HARQ transmission		4					
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM					
Number of OFDM symbols for PDCCH	OFDM symbols	2					
Precoder update granularity		Frequency domain: 1 PRB for Transmission mode 8, 1 PRG for Transmission modes 9 and 10 Time domain: 1 ms					
ACK/NACK feedback mode		Multiplexing					
Note 1: as specified in Table 4.2-2 in TS 36.211 [4] Note 2: as specified in Table 4.2-1 in TS 36.211 [4]							

8.3.2.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna port 5, the requirements are specified in Table 8.3.2.1-2, with the addition of the parameters in Table 8.3.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the demodulation performance using user-specific reference signals with full RB or single RB allocation.

Table 8.3.2.1-1: Test Parameters for Testing DRS

Parameter		Unit	Test 1	Test 2	Test 3	Test 4		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)		
	σ	dB	0	0	0	0		
Cell-specific refere	ence			Antenn	a port 0			
Beamforming mo	del		Annex B.4.1					
$N_{\it oc}$ at antenna p	ort	dB/15kHz	-98	-98	-98	-98		
Symbols for unused	PRBs		OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)	OCNG (Note 2)		
PDSCH transmiss mode	sion		7	7	7	7		

Note 1: $P_{R} = 0$.

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.1-2: Minimum performance DRS (FRC)

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Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.25 TDD	OP.1 TDD	EPA5	2x2 Low	70	-0.8	≥1
2	10 MHz 16QAM 1/2	R.26 TDD	OP.1 TDD	EPA5	2x2 Low	70	7.0	≥2
	5MHz 16QAM 1/2	R.26-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	7.0	1
3	10 MHz 64QAM 3/4	R.27 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.0	≥2
	10 MHz 64QAM 3/4	R.27-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.0	1
4	10 MHz 16QAM 1/2	R.28 TDD	OP.1 TDD	EPA5	2x2 Low	30	1.7	≥1

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.1-4 and 8.3.2.1-5, with the addition of the parameters in Table 8.3.2.1-3 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port.

Table 8.3.2.1-3: Test Parameters for Testing CDM-multiplexed DM RS (single layer)

Parameter		Unit	Test 1	Test 2	Test 3	Test 4	Test 5		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	0		
Downlink power allocation	$\rho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)	0 (Note 1)		
	σ	dB	-3	-3	-3	-3	-3		
Cell-specific reference signals	е		Antenna port 0 and antenna port 1						
Beamforming mode			Annex B.4.1						
$N_{\scriptscriptstyle oc}$ at antenna port	t	dBm/15kHz	-98	-98	-98	-98	-98		
Symbols for unused PRBs OCNG OCNG OCNG OCNG (Note 4) (Note 4) (Note 4)					OCNG (Note 4)				
Simultaneous transmission			No	No	No	Yes (Note 3, 5)	Yes (Note 3, 5)		
PDSCH transmission m	ode		8	8	8	8	8		

Note 1: $P_R = 1$.

Note 2: The modulation symbols of the signal under test is mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases.

Table 8.3.2.1-4: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC)

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.31 TDD	OP.1 TDD	EVA5	2x2 Low	70	-1.0	≥1
2	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	7.7	≥2
	5MHz 16QAM 1/2	R.32-1 TDD	OP.1 TDD	EPA5	2x2 Medium	70	7.7	1
3	10 MHz 64QAM 3/4	R.33 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.7	≥2
	10 MHz 64QAM 3/4	R.33-1 TDD	OP.1 TDD	EPA5	2x2 Low	70	17.7	1

Table 8.3.2.1-5: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
4	10 MHz	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	21.9	≥2
	16QAM 1/2	(Note 1)						
5	10 MHz	R.34 TDD	OP.1 TDD	EPA5	2x2 Low	70	22.0	≥2
	64QAM 1/2	(Note 1)						
Note 1:	The reference of	channel applie	s to both the	input signal unde	er test and the inte	rfering signal.		

8.3.2.1A Single-layer Spatial Multiplexing (with multiple CSI-RS configurations)

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.1A-2 and 8.3.2.1A-3, with the addition of the parameters in Table 8.3.2.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8 with and without a simultaneous transmission on the other antenna port, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.3.2.1A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Parameter		Unit	Test 1, Test 1a	Test 2	Test 3				
December neces	$ ho_{\scriptscriptstyle A}$	dB	0	0	0				
Downlink power allocation	$\rho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)				
	σ	dB	-3	-3	-3				
Cell-specific refere	ence			Antenna ports 0,1					
CSI reference sign	nals		Antenna ports 15,,22	Antenna ports 15,,18	Antenna ports 15,,18				
Beamforming mo	del		Annex B.4.1	Annex B.4.1	Annex B.4.1				
CSI-RS periodicity subframe offse Tcsi-Rs / Δcsi-Rs	t	Subframes	5 / 4	5/4	5 / 4				
CSI reference sig configuration	nal		1	3	3				
Zero-power CSI- configuration I _{CSI-RS} / ZeroPowerCSI-I- bitmap		Subframes / bitmap	4 / 0010000100000000	4 / 001000000000000000	4/ 001000000000000000				
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98	-98	-98				
Symbols for unus PRBs	sed		OCNG (Note 4)	OCNG (Note 4)	OCNG (Note 4)				
Number of alloca resource blocks (No		PRB	50	50	100				
Simultaneous transmission			No	Yes (Note 3, 5)	No				
PDSCH transmiss mode			9	9	9				
Number of MBSI subframes	-N	Subframes	2 (Note 6)	NA	NA				

Note 1: $P_R = 1$.

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 for CDM-multiplexed DM RS with interfering simultaneous transmission test cases.

Note 6: For TDD mode, 2 subframes (#4/9) are allocated as MBSFN subframes.

Table 8.3.2.1A-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference	Reference value		UE DL
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Category	Cat- egory
1	10 MHz QPSK 1/3	R.50-1 TDD	OP.1 TDD	EVA5	2x2 Low	70	-0.73	≥1	≥6
1a	10 MHz QPSK 1/3	R.50-2 TDD	OP.1 TDD	EVA5	2x2 Low	70	[-0.6]	≥1	≥6
3	20MHz 256QAM	R. 66 TDD	OP.1 TDD	EPA5	2x2 Low	70	24.3	11-12	≥11

Note 1: For UE that indicates support of *pdsch-CollisionHandling-r13*, test 1a will be run and test 1 will be skipped. Otherwise, test 1 will be run and test 1a will be skipped.

Table 8.3.2.1A-3: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
2	10 MHz 64QAM 1/2	R.44 TDD	OP.1 TDD	EPA5	2x2 Low	70	22.1	≥2
Note 1:	The reference	channel applie	s to both the	input signal unde	er test and the inte	rfering signal.		

8.3.2.1B Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model

The requirements are specified in Table 8.3.2.1B-2, with the addition of the parameters in Table 8.3.2.1B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed-loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.3.2.1B-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.3.2.1B-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model

paramete	r	Unit	Cell 1	Cell 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referer	nce signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference s			Antenna ports 15,,18	N/A
CSI-RS periodic subframe offset $T_{\rm CSI}$	-RS / \Delta CSI-RS	Subframes	5 / 4	N/A
CSI reference configuration			0	N/A
$N_{\it oc}$ at antenn	a port	dBm/15kH z	-98	N/A
DIP (Note	2)	dB	N/A	-1.73
BWChanne	I	MHz	10	10
Cyclic Pref	ix		Normal	Normal
Cell Id			0	126
Number of contro symbols	ol OFDM		2	2
PDSCH transmiss	ion mode		9	N/A
Beamforming ı	model		As specified in clause B.4.3 (Note 4, 5)	N/A
Interference n	nodel		N/A	As specified in clause B.5.4
Probability of occurrence of	Rank 1		N/A	70
transmission rank in interfering cells	Rank 2		N/A	30
Precoder update g	ranularity	PRB	50	6
PMI delay (No	ote 5)	ms	10 or 11	N/A
Reporting into	erval	ms	5	N/A
Reporting m	ode		PUCCH 1-1	N/A
CodeBookSubsetF bitmap	Restriction		000000000000000 0000000000000000 000000	N/A
Symbols for unus	ed PRBs		OCNG (Note 6)	N/A
Simultaneous tran			No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test	N/A
Physical channel reporting			PUSCH(Note 8)	N/A
cqi-pmi-Configura			4	N/A

Note 1: $P_B = 1$

Note 2: The respective received power spectral density of each interfering cell relative to N_{oc} ' is defined by its associated DIP value as specified in clause B.5.1.

Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.

Note 4:	The precoder in clause B.4.3 follows UE recommended PMI.
Note 5:	If the UE reports in an available uplink reporting instance at subrame SF#n based
	on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI
	cannot be applied at the eNB downlink before SF#(n+4).
Note 6:	These physical resource blocks are assigned to an arbitrary number of virtual UEs
	with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs
	shall be uncorrelated pseudo random data, which is QPSK modulated.
Note 7:	All cells are time-synchronous.
Note 8:	To avoid collisions between CQI reports and HARQ-ACK it is necessary to report
	both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in
	downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on
	PUSCH in uplink subframe SF#8 and #3.

Table 8.3.2.1B-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model

Test Number	Referenc e		NG tern		gation itions	Correlatio n Matrix	Reference Value		UE Categor
	Channel	Cell 1	Cell 2	Cell 1	Cell 2	and Antenna Configurat ion (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	у
1	R.48 TDD	OP.1 TDD	N/A	EVA5	EVA5	4x2 Low	70	-1.0	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

8.3.2.1C Single-layer Spatial Multiplexing (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

The requirements are specified in Table 8.3.2.1C-2, with the addition of parameters in Table 8.3.2.1C-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell if the PDSCH transmission in the serving cell takes place in subframes that overlap with ABS [9] of the aggressor cell with CRS assistance information. In Table 8.3.2.1C-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.2.1C-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports) – Non-MBSFN ABS

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Conf	iguration		1	1	1
Special subframe con	figuration		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	-3 (Note 1)	-3 (Note 1)
a	σ	dB	-3	N/A	N/A
	N_{oc1}	dBm/15kHz	-98 (Note 2)	N/A	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 3)	N/A	N/A
	N_{oc3}	dBm/15kHz	-93 (Note 4)	N/A	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.3.2.1C-2	12	10
BW _{Channel}		MHz	10	10	10
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	en Cells	Hz	N/A	300	-100
Cell Id			0	1	126
Cell-specific reference	e signals		A	ntenna ports 0,1	
CSI reference sig	ınals		Antenna ports 15,16	N/A	N/A
CSI-RS periodicity subframe offso Tcsi-Rs / \(\Delta\colon\)	et	Subframes	5/4	N/A	N/A
CSI reference signification			8	N/A	N/A
Zero-power CSI- configuration Icsi-RS / ZeroPowe bitmap	-RS	Subframes / bitmap	4 / 00100000000000 00	N/A	N/A
ABS pattern (No	te 5)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (I			000000001 000000001	N/A	N/A
CSI Subframe Sets	C _{CSI,0}		000000001 000000001	N/A	N/A
(Note7)	Ccsi,1		1100111000 1100111000	N/A	N/A
Number of control symbols	OFDM		2	Note 8	Note 8
PDSCH transmission mode			TM9-1layer	Note 9	Note 9
Precoding granularity			Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A
Beamforming mo			Annex B.4.1	N/A	N/A
Cyclic prefix			Normal	Normal	Normal

	Note 1:	$P_B = 1$.
	Note 2:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a
		subframe overlapping with the aggressor ABS.
	Note 3:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
	Note 4:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
	Note 5:	ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated
		PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is
		overlapped with the ABS subframe of aggressor cell and the subframe is available in the
		definition of the reference channel.
	Note 6:	Time-domain measurement resource restriction pattern for PCell measurements as defined
		in [7]
	Note 7:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
	Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe
	14010 0.	indicated by "0" of ABS pattern.
	Note 9:	Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3
		applying OCNG pattern as defined in Annex A.5.
	Note 10:	If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI
		estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at
		the eNB downlink before SF#(n+4).
	Note 11:	For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and
	N=4= 40:	4ms.
	Note 12:	
	Note 13:	SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.
ı	Note 14:	The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Table 8.3.2.1C-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports) - Non-MBSFN ABS

Test Number	Reference Channel	OC	NG Patt	ern		ropagations (N		Correlation Matrix and	Reference	Reference Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	gory
1	R.51 TDD	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5			2x2 Low	70	8.5	≥2
Note 1:	The propagat	ion cond	itions for	Cell 1, Ce	ell 2 and	Cell 3 are	e statistic	ally independen	t.		

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

8.3.2.1D Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM9 interference

The requirements are specified in Table 8.3.2.1D-2, with the addition of the parameters in Table 8.3.2.1D-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 9 interference model defined in clause B.6.4. In 8.3.2.1D-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1D-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM9 interference model

Parameter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Configurati			1	1	1
Special subframe configura	tion		4	4	4
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3
Cell-specific reference sign	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N _{oc} at antenna port		dBm/15kHz	,	-98	,
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Number of control OFDM synormal subframes			3	3	3
CFI indicated in PCFICH in subframes	normal		3	3	3
Number of control OFDM s special subframes	ymbols in		2	2	2
CFI indicated in PCFICH in subframes	special		2	2	2
PDSCH transmission mode	!		9	9	9
Interference model			N/A	As specified in clause B.6.4	As specified in clause B.6.4
Precoding			Random wideband precoding per TTI	As specified in clause B.6.4	As specified in clause B.6.4
CSI reference signals			Antenna ports 15, 16, 17, 18	Antenna ports 15, 16	Antenna ports 15, 16
CSI-RS periodicity and sub $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	frame offset	Subframes	10 / 4	10 / 4	10 / 4
CSI reference signal config	uration		5	6	7
Zero-power CSI-RS configu Icsi-RS /ZeroPowerCSI-RS b	ıration	Subframes / bitmap	9 / 10000000000 00000	9 / 01000000000 0000	9 / 00100000000 00000
Time offset to cell 1		us	N/A	2	3
Frequency offset to cell 1		Hz	N/A	200	300
MBSFN			Not configured	Not configured	Not configured
NeighCellsInfo- p-aLis		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}	
(Note 4) transn	nissionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1:

Cell 1 is the serving cell. Cell 2, 3 are the interfering cells. CSI-RS configurations are according to [4] subclause 6.10.5.2. NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. Note 2: Note 3:

Table 8.3.2.1D-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM9 interference model

Test Numb	Reference Channel	OCNG Pattern				pagati onditio			tion Mati a Config		Reference	UE Cate	
er		Cell Cell Cell 1 2 3		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory	
1	R.69 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	4x2 Low	2x2 Low	2x2 Low	85	18.0	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \hat{E}_{s}/N_{ac} of Cell 1 as defined in clause 8.1.1.

8.3.2.1E Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with CRS interference model

The requirements are specified in Table 8.3.2.1E-2, with the addition of the parameters in Table 8.3.2.1E-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by the CRS of the interfering cell, applying the CRS interference model defined in clause B.6.5. In 8.3.2.1E-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1E-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with CRS interference model

Parar	neter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Confi				1	1	1
Special subframe con	figuratio	n		4	4	4
		$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power alloca	ation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
		σ	dB	-3	-3	-3
Cell-specific reference	e signals			Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port			dBm/15kHz		-98	
\hat{E}_s/N_{oc}			dB	N/A	13.91	3.34
BW _{Channel}			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	1	6
Number of control OF normal subframes	DM sym	bols in		3	3	3
CFI indicated in PCFI subframes	CH in no	ormal		3	3	3
Number of control OF special subframes	ontrol OFDM symbols in			2	2	2
CFI indicated in PCFI subframes	CH in sp	ecial		2	2	2
PDSCH transmission	mode			8	N/A	N/A
Interference model				N/A	As specified in clause B.6.5	As specified in clause B.6.5
Precoding				Random wideband precoding per TTI	N/A	N/A
Time offset to cell 1			us	N/A	2	3
Frequency offset to cell 1 MBSFN		Hz	N/A	200	300	
				Not configured	Not configured	Not configured
NeighCellsInfo- r12 (Note 3) p-aList-r12 transmissionModeList -r12				N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
				N/A	{2,3,4,8,9}	{2,3,4,8,9}
Note 1: $P_{p} = 1$						

Note 1: $P_B = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.2.1E-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with CRS interference model

Test Number	Reference Channel	OCNG Pattern				opagat onditio		Correlation Reference Value Matrix and			UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.71 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	14.0	≥2

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.3.2.1F Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM3 interference

The requirements are specified in Table 8.3.2.1F-2, with the addition of the parameters in Table 8.3.2.1F-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of two interfering cells applying transmission mode 3 interference model defined in clause B.6.2. In 8.3.2.1F-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1F-1: Test Parameters for Testing CDM-multiplexed DM RS (Single-layer) with TM3 interference model

Parar	neter		Unit	Cell 1	Cell 2	Cell 3
Uplink downlink Confi	guratio	n		1	1	1
Special subframe con	figurat	ion		4	4	4
		$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power alloca	ation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	-3	-3
		σ	dB	-3	0	0
Cell-specific reference	e signa	ls		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port			dBm/15kHz		-98	
\hat{E}_s/N_{oc}			dB	N/A	3.28	0.74
BW _{Channel}			MHz	10	10	10
Cyclic Prefix				Normal	Normal	Normal
Cell Id				0	1	6
Number of control OF normal subframes	DM sy	mbols in		3	3	3
CFI indicated in PCFI subframes	CH in ı	normal		3	Random from set {1,2,3}	Random from set {1,2,3}
Number of control OF special subframes	DM sy	mbols in		2	2	2
CFI indicated in PCFI subframes	CH in s	special		2	Random from set {1,2}	Random from set {1,2}
PDSCH transmission	mode			8	3	3
Interference model				N/A	As specified in clause B.6.2	As specified in clause B.6.2
Precoding Time offset to cell 1 Frequency offset to cell 1				Random wideband precoding per TTI	As specified in clause B.6.2	As specified in clause B.6.2
		us	N/A	2	3	
			Hz	N/A	200	300
MBSFN				Not configured	Not configured	Not configured
NeighCellsInfo- p-aList-r12 r12		-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
(Note 4) transmissionModeLis		issionModeList		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1: $P_R = 1$

Note 2: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 3: CSI-RS configurations are according to [4] subclause 6.10.5.2.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 8.3.2.1F-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS with TM3 interference model

Test Number	Reference Channel	OCI	NG Pat	tern		opagat onditio		Correlation Matrix and	Reference	Value	UE Cate
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	gory
1	R.70 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	2x2 Low	85	11.3	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SNR corresponds to \hat{E}_{s}/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3.

8.3.2.1G Enhanced Performance Requirement Type B – Single-layer Spatial Multiplexing with TM10 serving cell configuration and TM9 interference model

The requirements are specified in Table 8.3.2.1G-2, with the addition of the parameters in Table 8.3.2.1G-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission configured with TM10 in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.6.3. The NAICS network assistance is provided when the serving cell TM10 is configured with QCL-type A and PCID based DM-RS scrambling. The neighbouring cell has transmission mode TM9 and NeighCellsInfo-r12 for interfering cell indicates presence of TM9. In 8.3.2.1G-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.3.2.1G-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) Multiplexing with TM10 serving cell configuration and TM9 interference model

Para	ameter		Unit	Cell 1	Cell 2	Cell 3	
Uplink downlink Con				1	1	1	
Special subframe co	nfiguratio	n		4	4	4	
		$ ho_{\scriptscriptstyle A}$	dB	0	0	0	
Downlink power allo	cation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0	
		σ	dB	-3	-3	-3	
Cell-specific referen	ce signals	3		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
N_{oc} at antenna port			dBm/15kHz		-98		
\hat{E}_s/N_{oc}			dB	N/A	13.91	3.34	
BW _{Channel}			MHz	10	10	10	
Cyclic Prefix				Normal	Normal	Normal	
Cell Id				0	1	6	
Number of control O normal subframes	•			3	3	3	
CFI indicated in PCF subframes				3	3	3	
Number of control O special subframes	FDM sym	bols in		2	2	2	
CFI indicated in PCF subframes	FICH in sp	pecial		2	2	2	
PDSCH transmission	n mode			10	9	9	
Interference model				N/A	As specified in clause B.6.4	As specified in clause B.6.4	
Precoding				Random wideband precoding per TTI	As specified in clause B.6.4	As specified in clause B.6.4	
CSI reference signal	ls			Antenna ports 15, 16, 17, 18	Antenna ports 15, 16	Antenna ports 15, 16	
CSI-RS periodicity a T _{CSI-RS} / Δ _{CSI-RS}	nd subfra	me offset	Subframes	10 / 4	10 / 4	10 / 4	
CSI reference signal	l configura	ation		5	6	7	
Zero-power CSI-RS I _{CSI-RS} /ZeroPowerCS	configura	tion	Subframes / bitmap	9 / 10000000000 00000	9 / 010000000000 0000	9 / 00100000000 00000	
Time offset to cell 1			us	N/A	2	3	
Frequency offset to cell 1			Hz	N/A	200	300	
MBSFN			Not configured	Not configured	Not configured		
NeighCellsInfo- r12 p-aList-r12			N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}		
(Note 4)				N/A	{2,3,4,8,9}	{2,3,4,8,9}	

Note 1: $P_{\scriptscriptstyle R}=1$

Note 2:

Cell 1 is the serving cell. Cell 2, 3 are the interfering cells. CSI-RS configurations are according to [4] subclause 6.10.5.2. Note 3:

NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]. Note 4:

Table 8.3.2.1G-2: Minimum Performance for Enhanced Performance Requirement Type B, CDM-multiplexed DM RS Multiplexing with TM10 serving cell configuration and TM9 interference model

Test Number	Reference Channel	OCNG Pattern			opagat onditio		Ma A	rrelat itrix a ntenr nfigu on	nd na	Reference \	Reference Value		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	C ell 1	C ell 2	C ell 3	Fraction of Maximum Throughput (%)	SNR (dB) (Note 2)	
1	R.69 TDD	OP. 1 TD D	N/A	N/A	EP A5	EP A5	EP A5	4x 2 Lo w	2x 2 Lo w	2x 2 Lo w	85	18.0	≥1

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

8.3.2.1H Single-layer Spatial Multiplexing (CRS assistance information is configured)

The requirements are specified in Table 8.3.2.1H-2, with the addition of parameters in Table 8.3.2.1H-1. The purpose is to verify the performance of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell with CRS assistance information. In Table 8.3.2.1H-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1, Cell 2 and Cell 3 is according to Annex C.3.2. The CRS assistance information [7] includes Cell 2 and Cell 3.

Table 8.3.2.1H-1: Test parameters of TM9-Single-Layer (2 CSI-RS ports)

Parar	meter	Unit	Cell 1	Cell 2	Cell 3			
Uplink downlink	Configuration		1	1	1			
Special subframe	e configuration		4	4	4			
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)			
anocation	σ	dB	-3	-3	-3			
N_{oc} at antenna p	oort	dBm/15kHz	-98	N/A	N/A			
Ê₅/N₀₀		dB	Reference Value in Table 8.3.2.1H-2	10.45	4.6			
BW _{Channel}		MHz	10	10	10			
Subframe Config	guration		Non-MBSFN	Non-MBSFN	Non-MBSFN			
Time Offset to C	ell 1	μs	N/A	3	-1			
Frequency shift t	to Cell 1	Hz	N/A	300	-100			
Cell Id			0	1	126			
Cell-specific refe	erence signals		Antenna ports 0,1					
CSI reference si			Antenna ports 15,16	N/A	N/A			
CSI-RS periodici subframe offset $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$	ity and	Subframes	5 / 4	N/A	N/A			
CSI reference significant configuration	gnal		8	N/A	N/A			
bitmap	PowerCSI-RS	Subframes / bitmap	4 / 0010000000000 000	N/A	N/A			
Number of control symbols	ol OFDM		2	2	2			
PDSCH transmis	ssion mode		TM9-1layer	N/A	N/A			
Interference mod	del		N/A	As specified in clause B.5.4	As specified in clause B.5.4			
	currence of nterference cells	%	N/A	20	20			
Probability of occurrence of transmission	Rank 1	%	N/A	80	80			
rank in interfering cells	Rank 2	%	N/A	20	20			
Precoding granu	larity		Frequency domain: 1 PRG Time domain: 1 ms	N/A	N/A			
Beamforming mo	odel		Annex B.4.1	N/A	N/A			
Cyclic prefix			Normal	Normal	Normal			

Note 1: $P_{R} = 1$

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate between 1ms and 4ms

Note 4: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.

Note 5: SIB-1 will not be transmitted in Cell 2 and Cell 3 in this test.

Note 6: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Table 8.3.2.1H-2: Minimum Performance of TM9-Single-Layer (2 CSI-RS ports)

		oc	NG Patt	ern		ropagati litions (N		Correlation Matrix and	Reference	Value	UE
Test Number	Reference Channel	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	Cate gory
1	R.51-1 TDD	OP.1 TDD	N/A	N/A		EVA5		2x2 Low	70	11.9	≥2

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to $\mathbb{E}_{\mathfrak{s}}/N_{\mathfrak{o}\mathfrak{o}}$ of cell 1.

8.3.2.11 Single-layer Spatial Multiplexing (With Enhanced DMRS table configured)

For single-layer transmission on antenna port 7, 8, 11 or 13 upon detection of a PDCCH with DCI format 2C, the requirement is specified in Table 8.3.2.1I-2, with the addition of the parameters in Table 8.3.2.1I-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of the test is to verify rank-1 performance on antenna port 11 with a simultaneous transmission on the antenna port 7, 8 or 13 with DMRS enhancement table and 4 orthogonal DMRS ports (dmrs-Enhancements-r13 UE-EUTRA-Capability [7]).

Table 8.3.2.1I-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations with Enhanced DMRS table

parameter		Unit	Test 1
Devention of the second	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Beamforming model			Annex B.4.1A
Cell-specific reference sig	gnals		Antenna ports 0,1
CSI reference signals	3		Antenna ports 15,,18
CSI-RS periodicity and sub- offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	oframe	Subframes	5/4
CSI reference signal configuration			3
Zero-power CSI-RS configuration I _{CSI-RS} / ZeroPowerCSI-RS bitm		Subframes / bitmap	4 / 00100000000000000
$N_{\it oc}$ at antenna port		dBm/15kHz	-98
Symbols for unused PR	RBs		OCNG (Note 4)
Number of allocated reso blocks (Note 2)	urce	PRB	50
Simultaneous transmiss	sion		Yes (Note 3, 5)
dmrs-Enhancements-r	13		Enable
PDSCH transmission m	ode		9
Note 1: $P_B = 1$.			

Note 2: The modulation symbols of the signal under test are mapped onto

antenna port 11.

Note 3: Modulation symbols of an interference signal are random mapped onto one antenna port among antenna port 7, 8 and 13. The upadate granularity for randomized mapping antenna port is 1 PRG in frequency domain and 1ms in time domain.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted

over the OCNG PDSCHs shall be uncorrelated pseudo random data,

which is QPSK modulated.

Note 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 with OCC =4.

Table 8.3.2.1I-2: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations with Enhanced DMRS table

Test	Bandwidth			Correlation	Reference value		UE			
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category		
1	10 MHz 64QAM 1/2	R.44 TDD	OP.1 TDD	EPA5	2x2 Low	70	22.1	≥2		
Note 1:	Note 1: The reference channel applies to both the input signal under test and the interfering signal.									

8.3.2.2 Dual-Layer Spatial Multiplexing

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2B, the requirements are specified in Table 8.3.2.2-2, with the addition of the parameters in Table 8.3.2.2-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation.

Table 8.3.2.2-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer)

Parame	ter	Unit	Test 1	Test 2	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0	
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	
allocation	σ	dB	-3	-3	
Cell-spec reference symbol	ce		Antenna port 0 and antenna por		
Beamforn model	_		Annex B.4.2		
N_{oc} at ant	enna	dBm/15kHz	-98	-98	
Symbols unused P			OCNG (Note 2)	OCNG (Note 2)	
Number of allocated resource blocks		allocated PRB		50	
PDSCI transmiss mode	sion		8	8	

Note 1: $P_B = 1$.

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.2-2: Minimum performance for CDM-multiplexed DM RS (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz QPSK 1/3	R.31 TDD	OP.1 TDD	EVA5	2x2 Low	70	4.5	≥2
2	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	21.7	≥2

8.3.2.2A Enhanced Performance Requirement Type C - Dual-Layer Spatial Multiplexing

The requirements are specified in Table 8.3.2.2A-2, with the addition of the parameters in Table 8.3.2.2A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation upon antenna ports 7 and 8.

Table 8.3.2.2A-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer)

Parameter		Unit	Test 1
Downlink $\rho_{\scriptscriptstyle A}$		dB	0
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
allocation	σ	dB	-3
Cell-sper reference symbol	ce		Antenna port 0 and antenna port 1
Beamforn mode			Annex B.4.2
N_{oc} at antenna port		dBm/15kHz	-98
Symbols for unused PRBs			OCNG (Note 2)
Number of allocated resource blocks		PRB	50
PDSCI transmiss mode	sion		8

Note 1: $P_B = 1$.

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one

an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.2A-2: Enhanced Performance Requirement Type C for CDM-multiplexed DM RS (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	value	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM 1/2	R.32 TDD	OP.1 TDD	EPA5	2x2 Medium	70	17.0	≥2

8.3.2.3 Dual-Layer Spatial Multiplexing (with multiple CSI-RS configurations)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.3.2.3-2, with the addition of the parameters in Table 8.3.2.3-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

Table 8.3.2.3-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations

Dore	Parameter		Test 1		
Fair	ameter	Unit	Cell 1	Cell 2	
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0	0	
	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	
	σ	dB	-3	-3	
	PDSCH_RA	dB	4	NA	
	PDSCH_RB	dB	4	NA	

Cell-specific reference signals		Antenna ports 0 and 1	Antenna ports 0 and 1
Cell ID		0	126
CSI reference signals		Antenna ports 15,16	NA
Beamforming model		Annex B.4.2	NA
CSI-RS periodicity and subframe offset Tcsi-rs / \(\Delta\colon\) ACSI-RS	Subframes	5 / 4	NA
CSI reference signal configuration		8	NA
Zero-power CSI-RS configuration ICSI-RS / ZeroPowerCSI-RS bitmap	Subframes / bitmap	4 / 00100000000000000	NA
$N_{\it oc}$ at antenna port	dBm/15kHz	-98	-98
\widehat{E}_s/N_{oc}		Reference Value in Table 8.3.2.3-2	Test specific, 7.25dB
Symbols for unused PRBs		OCNG (Note 2)	NA
Number of allocated resource blocks (Note 2)	PRB	50	NA
Simultaneous transmission		No	NA
PDSCH transmission mode		9	Blanked

Note 1: $P_B = 1$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.3-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test number	Bandwidth and MCS	Reference Channel		NG tern	Propagation Condition		Correlation Reference value Matrix and		UE Cate	
			Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	gory
1	10 MHz 16QAM 1/2	R.51 TDD	OP.1 TDD	N/A	ETU5	ETU5	2x2 Low	70	14.8	≥2

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

Note 3: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1.

8.3.2.4 Performance requirements for DCI format 2D and non Quasi Co-located Antenna Ports

8.3.2.4.1 Minimum requirement with Same Cell ID (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.1-3, with the additional parameters in Table 8.3.2.4.1-1 and Table 8.3.2.4.1-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the

timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6], configured according to Table 8.3.2.4.1-2. In Tables 8.3.2.4.1-1 and 8.3.2.4.1-2, transmission point 1 (TP 1) is the serving cell and transmission point 2 (TP 2) transmits PDSCH. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.2.4.1-1: Test Parameters for quasi co-location type B: same Cell ID

Parameter		Unit	TP 1	TP 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referer	nce signals		Antenna ports 0,1	(Note 2)
CSI-RS 0 antenr	na ports		NA	Port {15,16}
qcl-CSI-RS-Configl CSI-RS 0 period subframe offset $T_{\rm CSI}$	icity and -RS / ∆csi-RS	Subframes	NA	5/4
qcl-CSI-RS-Configl CSI-RS 0 config	uration		NA	8
csi-RS-ConfigZPId- power CSI-RS 0 co Icsi-RS / ZeroPower CSI-R	nfiguration		NA	4/ 0000010000000000
$N_{\it oc}$ at antenn	a port	dBm/15kH z	-98	-98
\widehat{E}_s/N_{oc}	\hat{E}_s/N_{oc}		Reference point in Table 8.3.2.4.1-3	Reference point in Table 8.3.2.4.1-3
BWChanne	BW _{Channel}		10	10
Cyclic Pref	ix		Normal	Normal
Cell Id			0	0
Number of contro symbols	ol OFDM		2	2
PDSCH transmiss	ion mode		Blanked	10
Number of alloca	ted PRB	PRB	NA	50
qcl-Operation, 'PDSCH RE Mapping and Quasi-Co- Location Indicator'			Туре	B, '00'
Time offset between	een TPs	μs	NA	Reference point in Table 8.3.2.4.1-3
Frequency error be	tween TPs	Hz	NA	0
Beamforming model			NA	Port 7 as specified in clause B.4.1
Symbols for unus	ed PRBs		NA	OCNG (Note 3)

Note 1: $P_{R} = 1$

Noet 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.1-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameters in each PQI set	DL transmission hypothesis for each PQI Set

	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH

Table 8.3.2.4.1-3: Minimum performance for quasi co-location type B: same Cell ID

Test Number	Reference Channel		iCN tern	Time offset between	set Conditions Matrix and		Correlation Matrix and Antenna	Reference \	/alue	UE Category
		TP 1	TP 2	TPs (μs)	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.52 TDD	NA	OP.1 TDD	2	EPA5	EPA5	2x2 Low	70	12	≥2
2	R.52 TDD	NA	OP.1 TDD	-0.5	EPA5	EPA5	2x2 Low	70	12.4	≥2

Note 1: The propagation conditions for TP 1 and TP 2 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for TP 1 and TP 2.

Note 3: SNR corresponds to \hat{E}_s/N_{ac} of TP 2 as defined in clause 8.1.1.

8.3.2.4.2 Minimum requirements with Same Cell ID (with multiple NZP CSI-RS resources)

The requirements are specified in Table 8.3.2.4.2-3, with the additional parameters in Tables 8.3.2.4.2-1 and 8.3.2.4.2-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission point share the same Cell ID. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. In Tables 8.3.2.4.2-1 and 8.3.2.4.2-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) has same Cell ID as TP 1. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between 2 TPs with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.2.4.2-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.2.4.2-1: Test Parameters for timing offset compensation with DPS transmission

parameter		Unit	TP 1	TP 2
$\rho_{\scriptscriptstyle A}$		dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

	,		
Beamforming model		As specified in clause B.4.1	As specified in clause B.4.1
Cell-specific reference signals		Antenna ports 0,1	(Note 2)
CSI reference signals 0		Antenna ports {15,16}	N/A
CSI-RS 0 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	5 / 4	N/A
CSI reference signal 0 configuration		0	N/A
CSI reference signals 1		N/A	Antenna ports {15,16}
CSI-RS 1 periodicity and subframe offset <i>T</i> _{CSI-RS} / Δ _{CSI-RS}	Subframes	N/A	5 / 4
CSI reference signal 1 configuration		N/A	8
Zero-power CSI-RS 0 configuration I _{CSI-RS} / ZeroPower CSI-RS bitmap	Subframes /bitmap	4/ 001000000000000000	N/A
Zero-power CSI-RS1 configuration /csi-Rs / ZeroPower CSI-RS bitmaps	Subframes /bitmap	N/A	4/ 00000100000000000
\widehat{E}_s/N_{oc}	dB	Reference Value in Table 8.3.2.4.2-3	Reference Value in Table 8.3.2.4.2-3
$N_{\it oc}$ at antenna port	dBm/15kH z	-98	-98
BWchannel	MHz	10	10
Cyclic Prefix		Normal	Normal
Cell Id		0	0
Number of control OFDM symbols		2	2
Timing offset between TPs		N/A	Reference Value in Table 8.3.2.4.2-3
Frequency offset between TPs	Hz	N/A	0
Number of allocated resource blocks	PRB	50	50
PDSCH transmission mode		10	10
Probability of occurrence of PDSCH transmission(Note 3)	%	30	70
Cure hala far unua ad DDDa		OCNIC (Nata 4)	OCNIC (Note 4)
Symbols for unused PRBs		OCNG (Note 4)	OCNG (Note 4)

Note 1: $P_{p} = 1$

Note 2: REs for antenna ports 0 and 1 have zero transmission power.

Note 3: PDSCH transmission from TPs shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.2-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	DL transmissior hypothesis for each PQI Set		
	NZP CSI-RS Index (For quasi co-location)	TP 1	TP 2	
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked
PQI set 1	CSI-RS 1	Blanked	PDSCH	

Table 8.3.2.4.2-3: Performance Requirements for timing offset compensation with DPS transmission

Test Number	Timing offset(us)	Reference Channel		NG tern		gation itions	Correlation Matrix and	Reference \	/alue	UE Category
			TP 1	TP 2	TP 1	TP 2	Antenna Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	2	R.53 TDD	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	70	12.3	≥2
2	-0.5	R.53 TDD	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	70	12.5	≥2
Note 1: Note 2:	1 1/2 3									
Note 3:	S: SNR corresponds to \hat{E}_s/N_{oc} of both TP 1 and TP 2 as defined in clause 8.1.1.									

8.3.2.4.3 Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)

The requirements are specified in Table 8.3.2.4.3-2, with the additional parameters in Table 8.3.2.4.3-1. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where the two transmission points have different Cell ID and colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. In Table 8.3.2.4.3-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, and transmission point 2 (TP 2) transmits PDSCH with different Cell ID. The downlink physical channel setup for TP 1 is according to Table C.3.4-1 and for TP 2 according to Table C.3.4-2.

Table 8.3.2.4.3-1: Test Parameters for quasi co-location type B with different Cell ID and Colliding CRS

paramete	r	Unit	TP 1	TP 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3

Beamforming model		N/A	As specified in clause B.4.2
Cell-specific reference signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference signals 0		N/A	Antenna ports {15,16}
CSI-RS 0 periodicity and subframe offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	Subframes	N/A	5/4
CSI reference signal 0 configuration		N/A	0
Zero-power CSI-RS 0 configuration I _{CSI-RS} / ZeroPower CSI-RS bitmap	Subframes /bitmap	N/A	4/ 00100000000000000
\hat{E}_s/N_{oc}	dB	Reference point in Table 8.3.2.4.3-2 + 4dB	Reference Value in Table 8.3.2.4.3-2
$N_{_{oc}}$ at antenna port	dBm/15kH z	-98	-98
BWchannel	MHz	10	10
Cyclic Prefix		Normal	Normal
Cell Id		0	126
Number of control OFDM symbols		1	2
Timing offset between TPs	us	N/A	0
Frequency offset between TPs	Hz	N/A	200
qcl-Operation, 'PDSCH RE Mapping and Quasi-Co- Location Indicator'		Туре	B, '00'
PDSCH transmission mode		Blank	10
Number of allocated resource block		N/A	50
Symbols for unused PRBs		N/A	OCNG(Note2)

Note 1: $P_B = 1$

These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs Note 2: shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.3-2: Performance Requirements for quasi co-location type B with different Cell ID and **Colliding CRS**

Test Number	Reference Channel		NG tern	Propagation Conditions (Note1)		Correlation Matrix and Antenna	Reference Value		UE Category
		TP 1	TP 2	TP 1	TP 2	Configuration (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	
1	R.54 TDD	N/A	OP.1 TDD	EPA5	ETU5	2x2 Low	70	14.7	≥2

Note 1:

The propagation conditions for TP 1 and TP 2 are statistically independent.

Correlation matrix and antenna configuration parameters apply for each of TP 1 and TP 2. Note 2:

SNR corresponds to \hat{E}_{s}/N_{oc} of TP 2 as defined in clause 8.1.1. Note 3:

8.3.2.4.4 Minimum requirement with Different Cell ID and non-Colliding CRS (with single NZP CSI-RS resource and CRS assistance information is configured)

The requirements are specified in Table 8.3.2.4.4-3, with the additional parameters in Table 8.3.2.4.4-1 and Table 8.3.2.4.4-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where three transmission points have different Cell ID and non-colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference and time difference between two transmission points, channel parameters estimation and rate matching behaviour according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' signalling defined in [6]. Further, the test verifies that the UE, configured with the CRS assistance information [7], can mitigate interference from CRS for demodulation. The CRS assistance information [7] includes TP 3. In Table 8.3.2.4.4-1, transmission point 1 (TP 1) is serving cell transmitting PDCCH, synchronization signals and PBCH, transmission point 2 (TP 2) transmits PDSCH with different Cell ID, and Transmission point 3 (TP 3) is the aggressor transmission point. The downlink physical channel setup for TP 1 is according to Table C.3.4-1, for TP 2 is according to Table C.3.4-2, and for TP 3 is according to Annex C.3.2.

Table 8.3.2.4.4-1: Test Parameters for quasi co-location type B with different Cell ID and non-colliding CRS when CRS assistance information is configured

parameter		Unit	TP 1	TP 2	TP 3
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
	σ	dB	-3	-3	-3
Beamforming mo	odel		N/A	Port 7 as specified in clause B.4.1	N/A
Cell-specific refe	rence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
CSI reference sig			N/A	Antenna ports {15,16}	N/A
CSI-RS 0 period subframe offset		Subframes	N/A	5 / 4	N/A
CSI reference sign configuration	gnal 0		N/A	0	N/A
Zero-power CSI- configuration I _{CSI-RS} / ZeroPower CSI-		Subframes /bitmap	N/A	4/	N/A
\hat{E}_s/N_{oc}		dB	10.45	Reference Value in Table 8.3.2.4.4-3	8.45
$N_{_{oc}}$ at antenna $_{ m I}$	oort	dBm/15kH z	-98	-98	N/A
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	128
Number of contro symbols	ol OFDM		1	2	2
Timing offset to 1	⁻ P 1	us	N/A	-0.5	3
Frequency offset		Hz	N/A	200	-100
qcl-Operation, P Mapping and Qu Location Indicate	asi-Co-		Туре В, '00'		N/A
PDSCH transmis	ssion mode		Blank	10	9
Number of alloca block	ited resource		N/A	50	N/A
Symbols for unus	sed PRBs		N/A	OCNG(Note2)	N/A
Interference model			N/A	N/A	As specified in clause B.5.4
Probability of occurrence of transmission in interference cells		%	N/A	N/A	20
Drobobility of	Rank 1	%	N/A	N/A	80
transmission	Rank 2	%	N/A	N/A	20

Note 1: $P_B = 1$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.4-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	h h			DL transmission hypothesis for each PQI Set	
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2	
PQI set 0	CSI-RS 0	ZP CSI-RS 0	Blanked	PDSCH	

Table 8.3.2.4.4-3: Performance Requirements for quasi co-location type B with different Cell ID and non-Colliding CRS when CRS assistance information is configured

	Refere	oci	NG Patte	rn	Propagation Conditions (Note1)		Correlation Matrix and	Reference Value		UE	
Test Number	nce Chann el	TP 1	TP 2	TP3	TP 1	TP 2	TP3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	Cate gory
1	R.52-1 TDD	N/A	OP.1 TDD	N/A	EVA5	EVA5	EVA5	2x2 Low	70	11.1	≥2

Note 1: The propagation conditions for TP.1, TP.2 and TP.3 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of TP.1, TP.2 and TP.3.

Note 3: SNR corresponds to \hat{E}_s/N_{oc} of TP.2 as defined in clause 8.1.1.

8.3.2.4.5 Minimum requirements with different Cell ID and non-colliding CRS (with multiple NZP CSI-RS resources and CRS assistance information is configured)

The requirements are specified in Table 8.3.2.4.5-3, with the additional parameters in Tables 8.3.2.4.5-1 and 8.3.2.4.5-2. The purpose of this test is to verify the UE capability of supporting non quasi-colocated antenna ports when the UE receives DCI format 2D in a scenario where three transmission point have the different Cell ID and non-colliding CRS. In particular the test verifies that the UE, configured with quasi co-location type B, performs correct tracking and compensation of the frequency difference and timing difference between two transmission points, channel parameters estimation and rate matching according to the 'PDSCH RE Mapping and Quasi-Co-Location Indicator' (PQI) signalling defined in [6]. Further, the test verifies that the UE, configured with the CRS assistance information [7], can mitigate interference from CRS for demodulation. The CRS assistance information [7] includes TP 3. In Tables 8.3.2.4.5-1 and 8.3.2.4.5-2, transmission point 1 (TP 1) is the serving cell transmitting PDCCH, synchronization signals and PBCH, Transmission point 2 (TP 2) has different Cell ID as TP 1, and Transmission point 3 (TP3) is the aggressor transmission point. Multiple NZP CSI-RS resources and ZP CSI-RS resources are configured. In each sub-frame, DL PDSCH transmission is dynamically switched between TP 1 and TP 2 with multiple PDSCH RE Mapping and Quasi-Co-Location Indicator configuration (PQI). Configurations of PDSCH RE Mapping and Quasi-Co-Location Indicator and downlink transmission hypothesis are defined in Table 8.3.2.4.5-2. The downlink physical channel setup for TP 1 is according to Table C.3.4-1, for TP 2 is according to Table C.3.4-2, and for TP 3 is according to Annex C.3.2

Table 8.3.2.4.5-1: Test Parameters for DPS transmission with CRS assistance information

parame	ter	Unit	TP 1	TP 2	TP 3
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	0
σ		dB	-3 As specified in	-3	-3 N/A
Beamforming mod	lel		clause B.4.1	As specified in clause B.4.1	
Cell-specific refere	ence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
CSI reference sign			Antenna ports {15,16}	N/A	N/A
CSI-RS 0 periodic subframe offset To		Subframes	5 / 4	N/A	N/A
CSI reference sign configuration			0	N/A	N/A
CSI reference sign	nals 1		N/A	Antenna ports {15,16}	N/A
CSI-RS 1 periodic subframe offset To		Subframes	N/A	5 / 4	N/A
CSI reference sign configuration			N/A	8	N/A
Zero-power CSI-R configuration Icsi-RS / ZeroPower CSI-R		Subframes /bitmap	4/ 00100000000000000	N/A	N/A
Zero-power CSI-R configuration I _{CSI-RS} / ZeroPower CSI-R	S1	Subframes /bitmap	N/A	4/ 0000010000000000	N/A
<u> </u>	\widehat{E}_s/N_{oc} (Note 2)		Reference Value in Table 8.3.2.4.5-3	Reference Value in Table 8.3.2.4.5-3	8.45
N_{oc} at antenna po	$N_{\it oc}$ at antenna port		-98	-98	N/A
BWchannel		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	128
Number of control symbols	OFDM		2	2	2
Timing offset to TF	P 1		N/A	-0.5	3
Frequency offset t	o TP 1	Hz	N/A	200	-100
Number of allocate blocks	ed resource	PRB	50	50	N/A
PDSCH transmiss	ion mode		10	10	9
Probability of occu		%	30	70	N/A
Symbols for unuse	` '		OCNG (Note 4)	OCNG (Note 4)	N/A
Interference model			N/A	N/A	As specified in clause B.5.4
Probability of occurrence of transmission in interference cells		%	N/A	N/A	20
transmission	Rank 1	%	N/A	N/A	80
rank in interfering F	Rank 2	%	N/A	N/A	20
Note 1: $P_B = 1$					

Note 2:	E /	$N_{\rm as}$ of TP 1 is set the same as that of TF	22
NOLG Z.	L . /		۷.

Note 3: PDSCH transmission from TP 1 and TP 2 shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TPs are specified.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.2.4.5-2: Configurations of PQI and DL transmission hypothesis for each PQI set

PQI set index	Parameter	DL transmission hypothesis for each PQI Set		
	NZP CSI-RS Index (For quasi co-location)	ZP CSI-RS configuration	TP 1	TP 2
PQI set 0	CSI-RS 0	ZP CSI-RS 0	PDSCH	Blanked
PQI set 1	CSI-RS 1	ZP CSI-RS 1	Blanked	PDSCH

Table 8.3.2.4.5-3: Performance Requirements for DPS transmission with CRS assistance information

	Refere	OCI	NG Patte	6 Pattern		rn Propagation Conditions (Note1)		Correlation Matrix and	Reference \	/alue	UE
Test Number	nce Chann el	TP 1	TP 2	TP3	TP 1	TP 2	TP3	Antenna Configurati on (Note 2)	Fraction of Maximum Throughput (%)	SNR (dB) (Note 3)	Cate gory
1	R.52-1 TDD	OP.1 TDD	OP.1 TDD	N/A	EVA5	EVA5	EVA5	2x2 Low	70	11.2	≥2

Note 1: The propagation conditions for TP.1, TP.2 and TP.3 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of TP.1, TP.2 and TP.3.

Note 3: SNR corresponds to \hat{E}_s/N_{oc} of both TP.1 and TP.2 as defined in clause 8.1.1.

8.3.3 LAA

8.3.3.1 Dual-Layer Spatial Multiplexing with DM-RS

8.3.3.1.1 FDD PCell (FDD single carrier)

The parameters specified in Table 8.3.3.1.1-1 are valid for FDD CC and LAA SCell(s) unless otherwise stated. And the additional parameters specified in Table 8.3.3.1.1-2 are valid for LAA SCell(s).

Table 8.3.3.1.1-1: Common Test Parameters

Parameter	Unit	Value
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes	Processes	8
Maximum number of HARQ transmission (Note 1)		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM
Precoder update granularity		Frequency domain: 1 PRG Time domain: 1 ms

Note 1: For retransmission in partial subframes, the TB size should be kept the same as the initial transmission regardless of the initial transmission is performed in full subframes or partial subframes.

Note 2: Void.

Table 8.3.3.1.1-2: Addtional Test Parameters for LAA SCell(s)

Parameter	Unit	Value
DMTC Periodicity	ms	80
dmtc-PeriodOffset-r12 ms80-r12		0
Discovery signal occasion duration	subframe	1
Power allocation of discovery signal		Same as power allocation of CRS within a transmission burst in the test

For CA with LAA SCell(s), the requirements for dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C are specified in Table 8.3.3.1.1-7, with the addition of the parameters in Table 8.3.3.1.1-3, Table 8.3.3.1.1-4 and Table 8.3.3.1.1-5. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation for CA with LAA SCell(s).

Table 8.3.3.1.1-3: Test Parameters for Large Delay CDD (FRC) for PCell

Parameter		Unit	Value
David laboration	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		TM3
Subframe configu	ıration		Non-MBSFN

NOTE 1: $P_B = 1$.

NOTE 2: PUCCH format 3 is used to feedback ACK/NACK.

NOTE 3: Void

Table 8.3.3.1.1-4: Test Parameters for CDM-multiplexed DM RS (dual layer) for CA with LAA SCell(s)

Parai	meter	Unit	Test 1
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
allocation	σ	dB	-3
	pecific e signals		Antenna ports 0 and 1
CSI refere	nce signals		Antenna ports 15,16
	orts (dual ismission)		port 7 and port 8
Beamform	ning model		Annex B.4.2
and subfra	oeriodicity ame offset / ∆csi-Rs	Subframes	5/2
	ence signal uration		8
config I _{CSI} ZeroPow	Zero-power CSI-RS configuration I _{CSI-RS} / ZeroPowerCSI-RS bitmap		3 / 00100000000000000
N_{oc} at an	tenna port	dBm/15kHz	-98
	or unused RBs		OCNG (Note 2)
	ansmission ode		9
transmissi	Burst ion pattern A SCell		As specified in B.8
subframes	The number of subframes set (S ₁) in a burst		{1,3,5,8}
Occupied OFDM symbols set in the last subframe			{6,9,12,14}
Random variable <i>p</i> defined in B.8			0.5
timing erro LAA SCe	timing error relative of LAA SCell to PCell		0
Frequency i-th LAA SO	Frequency offset of th i-th LAA SCell relative to PCell		200

Note 1: $P_B = 1$

Note 2: These physical resource blocks are assigned only within burst transmissions to a LAA UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.3.1.1-5: Single carrier performance Large Delay CDD (FRC) for PCell for multiple CA configurations

				Correlation	Reference value		
Band- width	Reference channel	OCNG pattern	Propa- gation condition	matrix and antenna config.	Fraction of Norminal maximum throughput (%)	SNR (dB)	
1.4MHz	R.11-5 FDD	OP.1 FDD	EVA70	2x2 Low	70	13.6	
3MHz	R.11-6 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3	
5MHz	R.11-2 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.3	
10MHz	R.11 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9	
15MHz	R.11-7 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.8	
20MHz	R.30 FDD	OP.1 FDD	EVA70	2x2 Low	70	12.9	

Table 8.3.3.1.1-6: Single carrier performance for CDM-multiplexed DM RS (dual layer) for LAA SCell for multiple CA configurations

					Correlation	Reference value	
Band- width	Sub-test (Note 2)	Reference channel	OCNG pattern	Propa- gation condition	matrix and antenna config.	Fraction of maximum throughput (%) (Note 1)	SNR (dB)
	1	R.2 FS3	OP.1 FS3	EVA5	2x2 Low	70	14.1
20MHz	2	R.2 FS3	OP.1 FS3	EVA5	2x2 Low	70	14
ZUIVIHZ	3	R.2 FS3	OP.1 FS3	EVA5	2x2 Low	70	14.2
	4	R.2 FS3	OP.1 FS3	EVA5	2x2 Low	70	14.2

Note 1: Fraction of nominal maximum throughput is calculated based on random occasions of LAA PDSCH transmission.

Note 2: An UE is required to fulfill only one test of Sub-test 1-4 depending on UE capabilities of endingDwPTS and secondSlotStartingPosition. For an UE not supporting both endingDwPTS and secondSlotStartingPosition, it is required to fulfill Sub-test 1; For an UE not supporting endingDwPTS but supporting secondSlotStartingPosition, it is required to fulfill Sub-test 2; For an UE supporting endingDwPTS but not supporting secondSlotStartingPosition, it is required to fulfil Sub-test 3; and For an UE supporting both endingDwPTS and secondSlotStartingPosition, it is required to fulfill Sub-test 4.

Table 8.3.3.1.1-7: Minimum performance (FRC) based on single carrier performance for CA with LAA SCell(s)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement (Note 2)	UE			
numbe r	Total PCell		LAA SCell		Category			
1	2x20	20	20	As defined in Table 8.3.3.1.1-5 and Table 8.3.3.1.1-6	≥5			
Note 1:	The applica 8.1.2.3C.	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in						

Note 2: Apply a per-CC requirement defined in Table 8.3.3.1.1-5 for PCell and apply a per-CC requirement defined in Table 8.3.3.1.1-6 for LAA SCell.

8.3.3.1.2 TDD Pcell (TDD single carrier)

The parameters specified in Table 8.3.3.1.2-1 are valid for TDD CC and LAA SCell(s) unless otherwise stated. And the additional parameters specified in Table 8.3.3.1.2-2 are valid for LAA SCell(s).

Table 8.3.3.1.2-1: Common Test Parameters

Parameter	Unit	Value
Uplink downlink configuration (Note 1)		1
Special subframe configuration (Note 2)		4
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes	Processes	7
Maximum number of HARQ transmission (Note 3)		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM
Precoder update granularity		Frequency domain: 1 PRG for Transmission modes 9 Time domain: 1 ms
ACK/NACK feedback mode	T. I.I. 4000: T000	Multiplexing

Note 1: As specified in Table 4.2-2 in TS 36.211 [4] Note 2: As specified in Table 4.2-1 in TS 36.211 [4]

Note 3: For retransmission in partial subframes, the TB size should be kept the same as the initial transmission regardless of the initial transmission is performed in full

subframes or partial subframes.

Table 8.3.3.1.2-2: Addtional Test Parameters for LAA SCell(s)

Parameter	Unit	Value
DMTC Periodicity	ms	80
dmtc-PeriodOffset-r12 ms80-r12		0
Discovery signal occasion duration	subframe	1
Power allocation of discovery signal		Same as power allocation of CRS within a transmission burst in the test

For CA with LAA SCell(s), the requirements for dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C are specified in Table 8.3.3.1.2-7, with the addition of the parameters in Table 8.3.3.1.2-3, Table 8.3.3.1.2-4 and Table 8.3.3.1.2-5, The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation for CA with LAA SCell(s).

Table 8.3.3.1.2-3: Test Parameters for Large Delay CDD (FRC) for PCell

Parameter		Unit	Value
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98
PDSCH transmission	on mode		TM3
Subframe configu	ıration		Non-MBSFN

NOTE 1: $P_B = 1$.

NOTE 2: PUCCH format 3 is used to feedback ACK/NACK.

NOTE 3: Void

Table 8.3.3.1.2-4: Test Parameters for CDM-multiplexed DM RS (dual layer) for LAA SCell(s)

Paran	neter	Unit	Test 1
Downlink	$ ho_{\scriptscriptstyle A}$	dB	4
power	$ ho_{\scriptscriptstyle B}$	dB	4 (Note 1)
allocation	allocation σ		-3
Cell-sp reference			Antenna ports 0 and 1
CSI refe			Antenna ports 15,16
DMRS po			port 7 and port 8
Beamformi	ing model		Annex B.4.2
CSI-RS po and subfra T _{CSI-RS} /	me offset $\Delta_{\text{CSI-RS}}$	Subframes	5/4
CSI refe			8
Zero-powe configue Icsi-F ZeroPowe bitm	er CSI-RS tration RS / erCSI-RS	Subframes / bitmap	4/ 00100000000000000
$N_{\it oc}$ at ant	enna port	dBm/15kHz	-98
Symbols for PRI			OCNG (Note 2)
PDS transmissi			9
DL B transmission for LAA	on pattern SCell		As specified in B.8
The nun subframes in a b	s set (S ₁) ourst		{1,3,5,8}
symbols s	Occupied OFDM symbols set in the last subframe		{6,9,12,14}
Random variable <i>p</i> defined in B.8			0.5
Timing error relative of LAA SCell to PCell		μs	0
Frequency th <i>i</i> -th LA relative t	A SCell	Hz	200

Note 1: $P_B = 1$

Note 2: These physical resource blocks are assigned only within burst transmissions to a LAA UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.3.3.1.2-5: Single carrier performance Large Delay CDD (FRC) for PCell for multiple CA configurations

			Propa-	Correlation	Reference value		
Band- width	Reference channel	OCNG pattern	gation condition	matrix and antenna config.	Fraction of maximum throughput (%)	SNR (dB)	
1.4MHz	R.11-5 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.2	
3MHz	R.11-6 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8	
5MHz	R.11-7 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.6	
10MHz	R.11-8 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.8	
15MHz	R.11-9 TDD	OP.1 TDD	EVA70	2x2 Low	70	12.9	
20MHz	R.30-1 TDD	OP.1 TDD	EVA70	2x2 Low	70	13.0	

Table 8.3.3.1.2-6: Single carrier performance for CDM-multiplexed DM RS (dual layer) for LAA SCell(s) for multiple CA configurations

						Reference va	lue
Band- width	Sub-test (Note2)	Reference channel	OCNG pattern	Propa- gation condition	Correlation matrix and antenna config.	Fraction of Norminal maximum throughput (%) (Note 1)	SNR (dB)
	1	R.2 FS3	OP.1 FS3	EVA5	2x2 Low	70	14.1
20MHz	2	R.2 FS3	OP.1 FS3	EVA5	2x2 Low	70	14
ZUIVITZ	3	R.2 FS3	OP.1 FS3	EVA5	2x2 Low	70	14.2
	4	R.2 FS3	OP.1 FS3	EVA5	2x2 Low	70	14.2

Note 1: Fraction of nominal maximum throughput is calculated based on random occasions of LAA PDSCH transmission.

Note 2: An UE is required to fulfill only one test of Sub-test 1-4 depending on UE capabilities of endingDwPTS and secondSlotStartingPosition. For an UE not supporting both endingDwPTS and secondSlotStartingPosition, it is required to fulfill Sub-test 1; For an UE not supporting endingDwPTS but supporting secondSlotStartingPosition, it is required to fulfill Sub-test 2; For an UE supporting endingDwPTS but not supporting secondSlotStartingPosition, it is required to fulfil Sub-test 3; and For an UE supporting both endingDwPTS and secondSlotStartingPosition, it is required to fulfill Sub-test 4.

Table 8.3.3.1.2-7: Minimum performance (FRC) based on single carrier performance for CA with LAA SCell(s)

Test	Aggregated Bandwidth (MHz)			Minimum performance requirement (Note 2)	UE				
numbe r	Total	PCell	LAA SCell		Category				
1	2x20 20 20			As defined in Table 8.3.3.1.2-5 and Table 8.3.3.1.2-6					
Note 1:	The applica 8.1.2.3C.	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 3.1.2.3C.							
Note 2:		-CC require .1.2-6 for LA		I in Table 8.3.3.1.2-5 for PCell and apply a per-CC requiremen	t defined in				

8.4 Demodulation of PDCCH/PCFICH

The receiver characteristics of the PDCCH/PCFICH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). PDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of PDCCH.

8.4.1 FDD

The parameters specified in Table 8.4.1-1 are valid for all FDD tests unless otherwise stated.

Normal

Single antenna **Transmit Parameter** Unit port diversity Number of PDCCH symbols symbols 2 2 PHICH Ng (Note 1) 1 PHICH duration Normal Normal Unused RE-s and PRB-s **OCNG** OCNG Cell ID 0 0 PDCCH_RA PHICH RA dΒ 0 -3 OCNG_RA Downlink power PCFICH_RB allocation PDCCH_RB dB 0 -3 PHICH_RB OCNG_RB -98 N_{ac} at antenna port dBm/15kHz -98

Normal

Table 8.4.1-1: Test Parameters for PDCCH/PCFICH

8.4.1.1 Single-antenna port performance

Note 1:

Cyclic prefix

According to Clause 6.9 in TS 36.211 [4]

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.1-1: Minimum performance PDCCH/PCFICH

Test number	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration	Refer val	ence ue
						and correlation Matrix	Pm- dsg (%)	SNR (dB)
1	10 MHz	8 CCE	R.15 FDD	OP.1 FDD	ETU70	1x2 Low	1	-1.7

8.4.1.2 Transmit diversity performance

8.4.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.2.1-1: Minimum performance PDCCH/PCFICH

Ī	Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
	number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
	1	10 MHz	4 CCE	R.16 FDD	OP.1 FDD	EVA70	2 x 2 Low	1	-0.6

8.4.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.1.2.2-1: Minimum performance PDCCH/PCFICH

Ī	Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
	number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
	1	5 MHz	2 CCE	R.17 FDD	OP.1 FDD	EPA5	4 x 2 Medium	1	6.3

8.4.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.4.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.3-4. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.4.1.2.3-1: Test Parameters for PDCCH/PCFICH - Non-MBSFN ABS

Paramete	r	Unit	Cell 1	Cell 2
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.4.1.2.3-	1.5
BWchanne	ı	MHz	10	10
Subframe Config	guration		Non-MBSFN	Non-MBSFN
Time Offset between	een Cells	μs	2.5 (synchro	nous cells)
Cell Id			0	1
ABS pattern (N	lote 4)		N/A	00000100 00000100 00000100 01000100 00000100
RLM/RRM Measureme Pattern (Not			00000100 00000100 00000100 00000100 00000100	N/A
CSI Subframe Sets	C _{CSI,0}		00000100 00000100 00000100 01000100 00000100	N/A
(Note 6)	Ccsi,1		11111011 11111011 11111011 10111011 11111011	N/A
Number of control OF			3	3
PHICH Ng (No			1	N/A
PHICH dura			Extended	N/A
Unused RE-s and			OCNG	OCNG
Cyclic pref	IX		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]:
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test.
- Note 9: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.1.2.3-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Numb er	Aggregati on Level	Referen ce Channel	OCNG Pattern		Cond	gation itions te 1)	Correlation Matrix and Antenna	Reference Value	
			Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Pm- dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	2x2 Low	1	-3.9

The propagation conditions for Cell 1 and Cell 2 are statistically independent. Note 1:

Note 2:

SNR corresponds to \hat{E}_s/N_{oc2} of cell 1. The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Note 3:

Table 8.4.1.2.3-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Paramet		Unit	Cell 1	Cell 2	
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A	
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A	
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A	
\widehat{E}_s/N_{oc2}		dB	Reference Value in Table 8.4.1.2.3-	1.5	
BW _{Channel}		MHz	10	10	
Subframe Conf	iguration		Non-MBSFN	MBSFN	
Time Offset betw	een Cells	μs	2.5 (synchro	nous cells)	
Cell Id			0	126	
ABS pattern (I	Note 4)		N/A	0001000000 0100000010 0000001000 0000000	
RLM/RRM Measurem Pattern (No			0001000000 0100000010 0000001000 0000000	N/A	
CSI Subframe Sets	Ccsi,0		0001000000 0100000010 0000001000 0000000	N/A	
(Note 6)	C _{CSI,1}		1110111111 1011111101 1111110111 1111111	N/A	
MBSFN Subframe Allocation (Note 9)			N/A	001000 100001 000100 000000	
Number of control O			3	3	
PHICH Ng (No			1	N/A	
PHICH dura			extended	N/A	
Unused RE-s ar			OCNG	OCNG	
Cyclic pre	HIX		Normal	Normal	

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13	
	of a subframe overlapping with the aggressor ABS.	

- Note 2: This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. The 4th, 12th, 19th and 27th subframes indicated by ABS pattern are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in this test.
- Note 9: MBSFN Subframe Allocation as defined in [7], four frames with 24 bits is chosen for MBSFN subframe allocation.
- Note 10: The maximum number of uplink HARQ transmission is ≤ 2 so that each PHICH channel transmission is in a subframe protected by MBSFN ABS in this test.
- Note 11: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.1.2.3-4: Minimum performance PDCCH/PCHICH - MBSFN ABS

Test Numb er	Aggregati on Level	Reference Channel		NG tern	Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value		
			Cell 1	Cell 2	Cell 1	Cell 2	Configurati on	Pm- dsg (%)	SNR (dB) (Note 2)	
1	8 CCE	R15-1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	2x2 Low	1	-4.2	

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

8.4.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.1-1 and Table 8.4.1.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.4-4.

In Tables 8.4.1.2.4-1 and 8.4.1.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell3are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.4.1.2.4-1: Test Parameters for PDCCH/PCFICH – Non-MBSFN ABS

Param	eter	Unit	Cell 1	Cell 2	Cell 3	
Douglink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3	
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3	
	N_{oc1}	dBm/15kHz	-98(Note 1)	N/A	N/A	
N_{oc} at antenna	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A	N/A	
port	N_{oc3}	dBm/15kHz	-93 (Note 3)	N/A	N/A	
\hat{E}_s/N		dB	Reference Value in Table 8.4.1.2.4-2	5	3	
BWch	annel	MHz	10	10	10	
Subframe Co	onfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
Time Offset be	etween Cells	μs	N/A	3	-1	
Frequency shift	between Cells	Hz	N/A	300	-100	
Cell	Id		0	126	1	
ABS patterr	n (Note 4)		N/A	00000100 00000100 00000100 00000100 00000100	00000100 00000100 00000100 00000100 00000100	
RLM/RRM Me Subframe Patt			00000100 00000100 00000100 00000100 00000100	N/A	N/A	
CSI Subframe	Ccsi,o		00000100 00000100 00000100 00000100 00000100	N/A	N/A	
Sets (Note 6)	Ccsl,1		11111011 11111011 11111011 11111011 11111011	N/A	N/A	
Number of control			2	Note 7	Note 7	
PHICH Ng	(Note 10)		1	N/A	N/A	
PHICH d			Normal	N/A	N/A	
Unused RE-s			OCNG	OCNG	OCNG	
Cyclic	orefix		Normal	Normal	Normal	

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe
	overlapping with the aggressor ABS.
Note 2:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7];
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];
Note 7:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 8:	The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.
Note 9:	SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.
Note 10	According to Clause 6.9 in TS 36.211 [4]

Table 8.4.1.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	oc	NG Patte	ern	Propagation Conditions (Note 1)			Correlation Matrix and	Reference Value	
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 FDD	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA5	EVA5	EVA5	2x2 Low	1	-2.2

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 1:

Note 2:

SNR corresponds to \hat{E}_{s}/N_{oc2} of cell 1. Note 3:

Table 8.4.1.2.4-3: Test Parameters for PDCCH/PCFICH – MBSFN ABS

Paran	neter	Unit	Cell 1	Cell 2	Cell 3	
Douglink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3	
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3	
	N_{oc1}	dBm/15kHz	-98(Note 1)	N/A	N/A	
N_{oc} at antenna	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A	N/A	
port	N_{oc3}	dBm/15kHz	-93 (Note 3)	N/A	N/A	
\hat{E}_s/I		dB	Reference Value in Table 8.4.1.2.4-4	5	3	
BW _C	nannel	MHz	10	10	10	
Subframe Co	onfiguration		Non-MBSFN	MBSFN	MBSFN	
Time Offset b	etween Cells	μs	N/A	3	-1	
Frequency shift	between Cells	Hz	N/A	300	-100	
Cell	l ld		0	126	1	
ABS patter	n (Note 4)		N/A	0001000000 0100000010 0000001000 0000000	0001000000 0100000010 0000001000 0000000	
RLM/RRM Measu Pattern (0001000000 0100000010 0000001000 0000000	N/A	N/A	
CSI Subframe	Ccsi,o		0001000000 0100000010 0000001000 0000000	N/A	N/A	
Sets (Note 6)	C _{CSI,1}		1110111111 1011111101 1111110111 1111111	N/A	N/A	
MBSFN Subframe Allocation (Note 7)			N/A	001000 100001 000100 000000	001000 100001 000100 000000	
Number of contro			2	Note 8	Note 8	
PHICH Ng			1	N/A	N/A	
PHICH o			Normal	N/A	N/A	
Unused RE-s			OCNG	OCNG	OCNG	
Cyclic	prefix		Normal	Normal	Normal	

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
Note 2:	This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
Note 3:	This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. The 4 th , 12 th , 19 th and 27 th subframes indicated by ABS pattern
	are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated
	PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped
	with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition
	of the reference channel.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in
	[7].
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI
	measurements defined in [7].
Note 7:	MBSFN Subframe Allocation as defined in [7], four frames with 24 bits are chosen for MBSFN
	subframe allocation.
Note 8:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe
	indicated by "0" of ABS pattern.
Note 9:	The maximum number of uplink HARQ transmission is ≤ 2 so that each PHICH channel
	transmission is in a subframe protected by MBSFN ABS in this test.
Note 10:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
Note 11:	·
1	OID 1 Min Hot Do Marion Mico III Con E and Con C III tillo toot.

Table 8.4.1.2.4-4: Minimum performance PDCCH/PCFICH - MBSFN ABS

Test	Aggregati	Reference	OCNG Pattern			Pı	ropagati	on	Correlation	Reference Value	
Number	on Level	Channel				Cond	itions (N	ote 1)	Matrix and		
			Cell 1	ell 1 Cell 2 Cell 3		Cell 1	Cell 2	Cell3	Antenna	Pm-	SNR
									Configuration	dsg	(dB)
									(Note 2)	(%)	(Note 3)
1	8 CCE	R.15-2	OP.1	OP.1	OP.1	EVA5	EVA5	EVA5	2x2 Low	1	-2.0
		FDD	FDD	FDD	FDD						

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 12: According to Clause 6.9 in TS 36.211 [4]

Note 3: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

8.4.1.2.5 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port under Asynchronous Network

The test purpose is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with interference model defined in clause B.5.2. For the parameters specified in Table 8.4.1-1 and Table 8.4.1.2.5-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.5-2 for the Enhanced Downlink Control Channel Performance Requirement Type A. In Table 8.4.1.2.5-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is not provided.

Table 8.4.1.2.5-1: Test Parameters for PDCCH/PCFICH

Param	neter	Unit	Cell 1	Cell 2	Cell 3
Downlink	PDCCH_RA PHICH_RA PDSCH_RA OCNG_RA	dB	-3	-3	-3
power allocation	PCFICH_RB PDCCH_RB PHICH_RB PDSCH_RB OCNG_RB	dB	-3	-3	-3
Cell-specific refere	ence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna po	ort	dBm/15kHz	0,1	-98	0,1
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of DL con OFDM symbols	trol region		3	3	3
PHICH Ng (Note 1)		1	N/A	N/A
PHICH duration			Normal	N/A	N/A
PDSCH TM			4	3	3
Interference mode	·I		N/A	As specified in clause B.5.2	As specified in clause B.5.2
Probability of occurrence of PDSCH transmiss	Rank 1	%	N/A	80	80
rank in interfering Rank 2 cells		%	N/A	20	20
Unused RE-s and PRB-s			OCNG	OCNG	OCNG
Time offset relative to Cell 1		ms	N/A	0.33	0.67
Frequency shift re		Hz	N/A	0	0
Note 1: Accordi	ng to Clause 6.9	in TS 36.211 [4]			

Table 8.4.1.2.5-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test Number	Aggregation level	Reference Channel	OCNG Pattern	Propag	Propagation Conditions (Note 2)		Antenna Configuration	Reference Value	
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm- dsg (%)	SNR (dB) (Note 4)
1	2 CCE	R.16-1 FDD	OP.1 FDD	EVA70	EVA70	EVA70	2x2 Low	1	16.5

Note 1: The OCNG pattern applies for Cell 1, Cell 2 and Cell 3.

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

8.4.1.2.6 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port with Non-Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the non-colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.1-1 and Table 8.4.1.2.6-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.6-2. In Table 8.4.1.2.6-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink

physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.1.2.6-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3		
	PDCCH_RA OCNG_RA	dB	-3	-3	-3		
Downlink			-3	N/A	N/A		
power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3		
	PHICH_RB	dB	-3	N/A	N/A		
Cell-specific reference signals			Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
N_{oc} at antenna ${ m p}$	oort	dBm/15kHz	-98				
\hat{E}_s/N_{oc}		dB	N/A 13.91		3.34		
BW _{Channel}			10	10	10		
Cyclic Prefix			Normal	Normal	Normal		
Cell Id			0	1	6		
Subframe Config	juration		Non-MBSFN	Non-MBSFN	Non-MBSFN		
Number of DL co OFDM symbols	ontrol region		3	3	3		
CFI indicated in	PCFICH		3	3	3		
PHICH Ng (Note	1)		1/6	N/A	N/A		
PHICH duration			Normal	N/A	N/A		
PDSCH TM			4	N/A	N/A		
Interference model			NA	As specified in clause B.7.1	As specified in clause B.7.1		
Unused RE-s and PRB-s (Note 2)			OCNG	OCNG	OCNG		
Time Offset relative to Cell 1		μs	N/A	2	3		
Frequency shift r	elative to Cell 1	Hz	N/A	200	300		
Note 1: Accor	ding to Clause 6.9 i	n TS 36.211 [4]					

Note 1: According to Clause 6.9 in 15 36.211 [4]

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.4.1.2.6-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test Number	Aggregation level	Reference Channel	OCNG Pattern		opagations (N		Antenna Configuration	Reference Value	
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	4 CCE	R.16-2 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	1	12.8

Note 1: The OCNG pattern applies for Cell 1, Cell 2 and Cell 3.

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

8.4.1.2.7 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port with Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type B for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.1-1 and Table 8.4.1.2.7-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.7-2. In Table 8.4.1.2.7-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.1.2.7-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3
	PDCCH_RA OCNG_RA	dB	-3	-3	-3
Downlink	PHICH_RA	dB	-3	N/A	N/A
power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3
	PHICH_RB	dB	-3	N/A	N/A
Cell-specific refe	Cell-specific reference signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna ${ m p}$	oort	dBm/15kHz		-98	
\hat{E}_s/N_{oc}	\hat{E}_s/N_{oc}		N/A 13.91		3.34
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	6	1
Subframe Config	uration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of DL co OFDM symbols	ontrol region		1	1	1
CFI indicated in	PCFICH		1	1	1
PHICH Ng (Note	1)		1/6	N/A	N/A
PHICH duration			Normal	N/A	N/A
PDSCH TM			4	N/A	N/A
Interference model			NA	As specified in clause B.7.1	As specified in clause B.7.1
Unused RE-s and PRB-s (Note 2)			OCNG	OCNG	OCNG
Time Offset relative to Cell 1		μs	N/A	2	3
Frequency shift r		Hz	N/A	200	300
Note 1: Accor	ding to Clause 6.9 i	n TS 36.211 [4]			

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.4.1.2.7-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test Number	Aggregation level	Reference Channel	OCNG Pattern		Propagation Conditions (Note 2)		Antenna Configuration	Refere	ence Value
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	2 CCE	R.16-3 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	1	12.7

Note 1: The OCNG pattern applies for Cell 1, Cell 2 and Cell 3.

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

8.4.1.2.8 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port with Non-Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type B for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the non-colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.1-1 and Table 8.4.1.2.8-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.1.2.8-2. In Table 8.4.1.2.8-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.1.2.8-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3
	PDCCH_RA OCNG_RA	dB	-3	-3	-3
Downlink	PHICH_RA	dB	-3	N/A	N/A
power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3
	PHICH_RB	dB	-3	N/A	N/A
Cell-specific refe	Cell-specific reference signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna ${ m p}$	oort	dBm/15kHz		-98	
\hat{E}_s/N_{oc}	\hat{E}_s/N_{oc}		N/A 13.91		3.34
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
Subframe Config			Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of DL co OFDM symbols	ontrol region		1	1	1
CFI indicated in	PCFICH		1	1	1
PHICH Ng (Note	1)		1/6	N/A	N/A
PHICH duration			Normal	N/A	N/A
PDSCH TM			4	N/A	N/A
Interference model				As specified in clause B.7.1	As specified in clause B.7.1
Unused RE-s and PRB-s (Note 2)			OCNG	OCNG	OCNG
Time Offset relative to Cell 1		μs	N/A	2	3
Frequency shift r		Hz	N/A	200	300
Note 1: Accor	ding to Clause 6.9 i	n TS 36.211 [4]			

For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.4.1.2.8-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel **Performance Requirement Type B**

Test Number	Aggregation level	Reference Channel	OCNG Pattern		Propagation Conditions (Note 2)		Antenna Configuration	Refere	ence Value
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	4 CCE	R.16-4 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	1	10.3

Note 1:

The OCNG pattern applies for Cell 1, Cell 2 and Cell 3.
The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 2:

Note 3:

Note 4: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

8.4.2 **TDD**

The parameters specified in Table 8.4.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.4.2-1: Test Parameters for PDCCH/PCFICH

Parame	eter	Unit	Single antenna port	Transmit diversity
Uplink downlink (Note			0	0
Special subframe (Note	•		4	4
Number of PDCCH symbols		symbols	2	2
PHICH Ng (Note 3)			1	1
PHICH duration			Normal	Normal
Unused RE-s and PRB-s			OCNG	OCNG
Cell ID			0	0
Downlink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	0	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3
N_{oc} at antenna port		dBm/15kHz	-98	-98
Cyclic prefix			Normal	Normal
ACK/NACK feed	dback mode		Multiplexing	Multiplexing
Note 1: as speci	fied in Table 4.2	2-2 in TS 36.211 [4	1].	

Note 1: as specified in Table 4.2-2 in TS 36.211 [4]. Note 2: as specified in Table 4.2-1 in TS 36.211 [4]. Note 3: According to Clause 6.9 in TS 36.211 [4]

8.4.2.1 Single-antenna port performance

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		level	Channel	Pattern	Condition	configuration	Pm-dsg (%)	SNR (dB)
						and		
						correlation		
						Matrix		
1	10 MHz	8 CCE	R.15 TDD	OP.1 TDD	ETU70	1x2 Low	1	-1.6

8.4.2.2 Transmit diversity performance

8.4.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	ce value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 CCE	R.16 TDD	OP.1 TDD	EVA70	2 x 2 Low	1	0.1

8.4.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.2.2.2-1: Minimum performance PDCCH/PCFICH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 TDD	OP.1 TDD	EPA5	4 x 2 Medium	1	6.5

8.4.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3.. In Table 8.4.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.3-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.3-4. The downlink physical channel setup for Cell 1 is according to Annex C3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.4.2.2.3-1: Test Parameters for PDCCH/PCFICH - Non-MBSFN ABS

Paramete	Parameter		Cell 1	Cell 2	
Uplink downlink co	Uplink downlink configuration		1	1	
Special subframe configuration			4	4	
Downlink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A	
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A	
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A	
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.4.2.2.3-2	1.5	
BWchannel		MHz	10	10	
Subframe Configuration			Non-MBSFN	Non-MBSFN	
Time Offset between Cells		μ\$	2.5 (synchronous cells)		
Cell Id			0	1	
ABS pattern (N	lote 4)		N/A	0000010001 0000000001	
RLM/RRM Measurem Pattern(Note			000000001 000000001	N/A	
CSI Subframe	C _{CSI,0}		0000010001 000000001	N/A	
Sets(Note 6)	C _{CSI,1}		1100101000 1100111000	N/A	
Number of control OFDM symbols			3	3	
ACK/NACK feedback mode		-	Multiplexing	N/A	
PHICH Ng (Note 9)			1	N/A	
PHICH duration		·	extended	N/A	
Unused RE-s an Cyclic pref	d PRB-s		OCNG Normal	OCNG Normal	

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test.
- Note 9: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.2.2.3-2: Minimum performance PDCCH/PCFICH - Non-MBSFN ABS

Test Numbe r	Aggregatio n Level	Referenc e Channel	OCNG	Pattern	Propagation Conditions (Note 1)		Correlation Matrix and Antenna	Reference Value	
			Cell 1	Cell 2	Cell 1	Cell 2	Configuration	Pm- dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Low	1	-3.9

The propagation conditions for Cell 1 and Cell 2 are statistically independent. Note 1:

Note 2:

SNR corresponds to \hat{E}_s/N_{oc2} of cell 1. The correlation matrix and antenna configuration apply for Cell 1 and Cell 2. Note 3:

Table 8.4.2.2.3-3: Test Parameters for PDCCH/PCFICH - MBSFN ABS

Paramete	er	Unit	Cell 1	Cell 2
Uplink downlink configuration			1	1
Special subframe co	Special subframe configuration		4	4
Downlink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.4.2.2.3-4	1.5
BW _{Channel}		MHz	10	10
Subframe Configuration Time Offset between Cells			Non-MBSFN	MBSFN
		μS	2.5 (synchronous cells)	
Cell Id			0	126
ABS pattern (Note 4)			N/A	000000001 000000001
RLM/RRM Measurem Pattern(Note			000000001 000000001	N/A
CSI Subframe	C _{CSI,0}		000000001 000000001	N/A
Sets(Note 6)	C _{CSI,1}		1100111000 1100111000	N/A
MBSFN Subframe Allocation (Note 9) Number of control OFDM symbols ACK/NACK feedback mode			N/A	000010
			3	3
			Multiplexing	N/A
PHICH Ng (Note 10)			1	N/A
PHICH duration			extended	N/A
	Unused RE-s and PRB-s		OCNG	OCNG
Cyclic pret	fix		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. The 10th and 20th subframes indicated by ABS pattern are MBSFN ABS subframes.PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in this test.
- Note 9: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.
- Note 10: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.2.2.3-4: Minimum performance PDCCH/PCFICH - MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OCNG	OCNG Pattern		jation s(Note 1)	Correlation Matrix and	Referen	ce Value
			Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Pm-dsg (%)	SNR (dB) (Note 2)
1	8 CCE	R15-1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	2x2 Low	1	-4.1

Note 1: The propagation conditions for Cell 1 and Cell2 are statistically independent.

Note 2: SNR corresponds to \hat{E}_s/N_{ac2} of cell 1.

Note 3: The correlation matrix and antenna configuration apply for Cell 1 and Cell 2.

8.4.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters for non-MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-2.

For the parameters for MBSFN ABS specified in Table 8.4.2-1 and Table 8.4.2.2.4-3, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.4-4.

In Tables 8.4.2.2.4-1 and 8.4.2.2.4-3, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.4.2.2.4-1: Test Parameters for PDCCH/PCFICH - Non-MBSFN ABS

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Uplink downlink	configuration		1	1	1
Special subframe	configuration		4	4	4
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	1	-3	
	N_{oc1}	dBm/15kHz	-98(Note 1)	N/A	N/A
N_{oc} at antenna	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	N_{oc3}	dBm/15kHz	-93 (Note 3)	N/A	N/A
\hat{E}_s/N	\widehat{E}_s/N_{oc2}		Value in Table	5	3
BW _{Channel} Subframe Configuration Time Offset between Cells		MHz	10	10	10
			Non-MBSFN	Non-MBSFN	Non-MBSFN
		μs	N/A	3	-1
Frequency shift I	between Cells	Hz	N/A	300	-100
Cell	ld		0	126	1
ABS pattern	(Note 4)		N/A		0000000001 0000000001
RLM/RRM Me Subframe Patt				N/A	N/A
CSI Subframe	Ccsi,0			N/A	N/A
Sets (Note 6)	C _{CSI,1}		1100111000	N/A	N/A
Number of cor symb			2	Note 7	Note 7
ACK/NACK fee			Multiplexina	N/A	N/A
PHICH Ng (N/A
PHICH di			Normal	N/A	N/A
Unused RE-s			OCNG	OCNG	OCNG
Cyclic p	orefix		Normal	Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PDCCH/PCFICH other than that associated with SIB1/Paging are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7];
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7];
- Note 7: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 8: The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.
- Note 9: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.
- Note 10: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.2.2.4-2: Minimum performance PDCCH/PCFICH – Non-MBSFN ABS

Test Number	Aggregati on Level	Reference Channel	OC	OCNG Pattern Propagation Conditions (Note 1)			Correlation Matrix and	Referer	nce Value		
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 TDD	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	1	-2.0

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

Table 8.4.2.2.4-3: Test Parameters for PDCCH/PCFICH - MBSFN ABS

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Uplink downlink	configuration		1	1	1
Special subframe	e configuration		4	4	4
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	tion ation	-3	-3	-3
	N_{oc1}	dBm/15kHz	-98 (Note 1)	N/A	N/A
N_{oc} at antenna	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	N_{oc3}	dBm/15kHz	-93 (Note 3)	N/A	N/A
\hat{E}_s/N		dB	Reference Value in Table 8.4.2.2.4-4	5	3
BW _{Channel}		MHz	10	10	10
Subframe Co	Subframe Configuration		Non-MBSFN	MBSFN	MBSFN
Time Offset be	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cell	ld		0	126	1
ABS pattern	` ,		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Me Subframe Patt			0000000001 0000000001	N/A	N/A
CSI Subframe	Ccsi,0		0000000001 0000000001	N/A	N/A
Sets (Note 6)	C _{CSI,1}		1100111000 1100111000	N/A	N/A
MBSFN Subfrai			N/A	000010	000010
Number of control	,		2	Note 8	Note 8
ACK/NACK fee			Multiplexing	N/A	N/A
PHICH Ng			1	N/A	N/A
PHICH d	uration		Normal	N/A	N/A
Unused RE-s			OCNG	OCNG	OCNG
Cyclic	orefix		Normal	Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13 of a subframe overlapping with the aggressor ABS.
- Note 2: This noise is applied in OFDM symbols #0 of a subframe overlapping with the aggressor ABS.
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. The 10th and 20th subframes indicated by ABS pattern are MBSFN ABS subframes. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the MBSFN ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 7: MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation.
- Note 8: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 10: SIB-1 will not be transmitted in Cell2 in this test.
- Note 11: According to Clause 6.9 in TS 36.211 [4]

Table 8.4.2.2.4-4: Minimum (performance	PDCCH/PCFICH -	- MBSFN ABS
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Test Number	Aggregati on Level	Reference Channel	oc	OCNG Pattern			ropagationitions (N		Correlation Matrix and	Referer	nce Value
			Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell3	Antenna Configuration (Note 2)	Pm- dsg (%)	SNR (dB) (Note 3)
1	8 CCE	R.15-2 TDD	OP.1 TDD	OP.1 TDD	OP.1 TDD	EVA5	EVA5	EVA5	2x2 Low	1	-1.8

Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.

Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 3: SNR corresponds to \hat{E}_s/N_{oc2} of cell 1.

8.4.2.2.5 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port with Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.2-1 and Table 8.4.2.5-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.5-2. In Table 8.4.2.2.5-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.2.2.5-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3		
	PDCCH_RA OCNG_RA	dB	-3	-3	-3		
Downlink	PHICH_RA	dB	-3	N/A	N/A		
power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3		
	PHICH_RB	dB	-3	N/A	N/A		
Cell-specific refe			Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
$N_{\it oc}$ at antenna ${ m p}$	oort	dBm/15kHz		-98			
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34		
BW _{Channel}		MHz	10	10	10		
Cyclic Prefix			Normal	Normal	Normal		
Cell Id			0	6	1		
UL/DL Configura	ition		0	0	0		
Special Subfram	e Configuration		4	4	4		
Subframe Config	juration		Non-MBSFN	Non-MBSFN	Non-MBSFN		
Number of DL co OFDM symbols	ontrol region		3 for subframes 0 and 5 2 for subframes 1 and 6				
CFI indicated in	PCFICH			for subframes 0 and for subframes 1 and			
PHICH Ng (Note	: 1)		1/6	N/A	N/A		
PHICH duration			Normal	N/A	N/A		
PDSCH TM			4	N/A	N/A		
Interference mod	del			As specified in clause B.7.1	As specified in clause B.7.1		
Unused RE-s an	d PRB-s (Note 2)		OCNG	OCNG	OCNG		
Time Offset relat	Time Offset relative to Cell 1		N/A	2	3		
Frequency shift r	elative to Cell 1	μs Hz	N/A	200	300		
Note 1: Accor	ding to Clause 6.9 i	n TS 36.211 [4]					

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.4.2.2.5-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel **Performance Requirement Type A**

Test Number	Aggregation level	Reference Channel	OCNG Pattern		Propagation Antenna Reference distincts (Note 2) Configuration		ence Value		
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	2 CCE	R.16-1 TDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 Low	1	16.1

The OCNG pattern applies for Cell 1, Cell 2 and Cell 3. Note 1:

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 3:

SNR corresponds to E_s/N_{oc} of Cell 1 as defined in clause 8.1.1. Note 4:

8.4.2.2.6 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Port with Non-Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the non-colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.2-1 and Table 8.4.2.2.6-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.6-2. In Table 8.4.2.2.6-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.2.2.6-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3
	PDCCH_RA OCNG_RA	dB	က	-3	-3
Downlink	PHICH_RA	dB	-3	N/A	N/A
power	PCFICH_RB				
allocation	PDCCH_RB	dB	-3	-3	-3
	OCNG_RB				
	PHICH_RB	dB	-3	N/A	N/A
Cell-specific refe	rence signals		Antenna ports	Antenna ports	Antenna ports
Con opcomo roio	Torroo digridio		0,1	0,1	0,1
N_{oc} at antenna p	ort	dBm/15kHz		-98	
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	1	6
UL/DL Configura	tion		0	0	0
Special Subframe			4	4	4
Subframe Config			Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of DL co	ntrol region		_	or subframes 0 and	-
OFDM symbols				or subframes 1 and	
CFI indicated in F	PCFICH			or subframes 0 and	
				or subframes 1 and	
PHICH Ng (Note	1)		1/6	N/A	N/A
PHICH duration			Normal	N/A	N/A
PDSCH TM			4	N/A	N/A
Interference mod	el			As specified in	As specified in
	1000 (N) (S)		00110	clause B.7.1	clause B.7.1
Unused RE-s and			OCNG	OCNG	OCNG
Time Offset relati		μs	N/A	2	3
Frequency shift r	elative to Cell 1	Hz	N/A	200	300

Note 1:

According to Clause 6.9 in TS 36.211 [4]. For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs. Note 2:

Table 8.4.2.2.6-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test Number	Aggregation level	Reference Channel	OCNG Pattern		opagations (N		Antenna Configuration	Reference Value	
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	4 CCE	R.16-2 TDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 Low	1	13.3

Note 1: The OCNG pattern applies for Cell 1, Cell 2 and Cell 3.

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

8.4.2.2.7 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port with Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type B for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.2-1 and Table 8.4.2.2.7-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.7-2. In Table 8.4.2.2.7-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.2.2.7-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3
	PDCCH_RA OCNG_RA	dB	-3	-3	-3
Downlink	PHICH_RA	dB	-3	N/A	N/A
power	PCFICH_RB				
allocation	PDCCH_RB	dB	-3	-3	-3
	OCNG_RB				
	PHICH_RB	dB	-3	N/A	N/A
Cell-specific refe	rence cianale		Antenna ports	Antenna ports	Antenna ports
Cell-specific rele	Terice signais		0,1	0,1	0,1
N_{oc} at antenna ${ m p}$	oort	dBm/15kHz		-98	
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Cell Id			0	6	1
UL/DL Configura	tion		0	0	0
Special Subfram	e Configuration		4	4	4
Subframe Config			Non-MBSFN	Non-MBSFN	Non-MBSFN
Number of DL co OFDM symbols	ontrol region		1	1	1
CFI indicated in	PCFICH		1	1	1
PHICH Ng (Note	1)		1/6	N/A	N/A
PHICH duration			Normal	N/A	N/A
PDSCH TM			4	N/A	N/A
Interference mod	lel			As specified in	As specified in
				clause B.7.1	clause B.7.1
	d PRB-s (Note 2)		OCNG	OCNG	OCNG
Time Offset relat	ive to Cell 1	μs	N/A	2	3
Frequency shift r	elative to Cell 1	Hz	N/A	200	300

Note 1: According to Clause 6.9 in TS 36.211 [4].

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.4.2.2.7-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test Number	Aggregation level	Reference Channel	OCNG Pattern		opagations (N		Antenna Configuration		
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	2 CCE	R.16-3 TDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 Low	1	13.7

Note 1: The OCNG pattern applies for Cell 1, Cell 2 and Cell 3.

Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 3: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.

Note 4: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

8.4.2.2.8 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Port with Non-Colliding CRS Dominant Interferer

The purpose of this test is to verify the Enhanced Downlink Control Channel Performance Requirement Type A for PDCCH/PCFICH with 2 transmit antennas for the case of dominant interferer with the non-colliding CRS pattern and applying interference model defined in clause B.7.1. For the parameters specified in Table 8.4.2-1 and Table 8.4.2.2.8-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.2.2.8-2. In Table 8.4.2.2.8-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.4.2.2.8-1: Test Parameters for PDCCH/PCFICH

Para	meter	Unit	Cell 1	Cell 2	Cell 3			
	PDCCH_RA OCNG_RA	dB	-3	-3	-3			
Downlink	PHICH_RA	dB	-3	N/A	N/A			
power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3			
	PHICH_RB	dB	-3	N/A	N/A			
Cell-specific refe					Antenna ports 0,1			
N_{oc} at antenna ${ m p}$	oort	dBm/15kHz	-98					
\hat{E}_s/N_{oc}	dB N/A 13.91				3.34			
BW _{Channel}	3WChannel		10 10 10					
Cyclic Prefix			Normal	Normal	Normal			
Cell Id	Cell Id		0	1	6			
UL/DL Configura	ition		0	0	0			
Special Subfram	e Configuration		4	4	4			
Subframe Config			Non-MBSFN	Non-MBSFN	Non-MBSFN			
Number of DL co OFDM symbols	ontrol region		1	1	1			
CFI indicated in	PCFICH		1	1	1			
PHICH Ng (Note	: 1)		1/6	N/A	N/A			
PHICH duration			Normal	N/A	N/A			
PDSCH TM			4	N/A	N/A			
Interference mod	Interference model			As specified in clause B.7.1	As specified in clause B.7.1			
Unused RE-s an	d PRB-s (Note 2)		OCNG	OCNG	OCNG			
Time Offset relat	ive to Cell 1	μs	N/A	2	3			
Frequency shift r	relative to Cell 1	Hz	N/A	200	300			
Note 1: According to Clause 6.9 in TS 36.211 [/]								

Note 1: According to Clause 6.9 in TS 36.211 [4].

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.4.2.2.8-2: Minimum Performance for PDCCH/PCFICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test Number	Aggregation level	Reference Channel	OCNG Pattern		Propagation Conditions (Note 2)		Antenna Configuration	Reference Value	
			(Note 1)	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 3)	Pm-dsg (%)	SNR (dB) (Note 4)
1	4 CCE	R.16-4 TDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 Low	1	11.2
Note 1: Note 2: Note 3:		n conditions fo	or Cell 1, Cel	II 2 and C	Cell 3 are		ally independent. ell 2 and Cell 3.		
Note 4:	SNR corresponds to \hat{E}_s/N_{cc} of Cell 1 as defined in clause 8.1.1.								

8.4.3 LAA

The parameters specified in Table 8.4.3-1 are valid for all LAA PDCCH tests unless otherwise stated.

Table 8.4.3-1: Common test Parameters for PDCCH

Parame	eter	Unit	Transmit diversity			
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3			
allocation (Note 1)	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3			
$N_{\it oc}$ at anter	nna port	dBm/15kHz	-98			
PHICH Ng ((Note 1)		1			
PHICH du	ration		Normal			
Unused RE-s and 2)	PRB-s (Note		OCNG			
Cell II)		0			
Cyclic pr	efix		Normal			
ACK/NACK feed			Multiplexing			
		I_RB, PHICH_RA,	and			
PHICH_	PHICH_RB are not available.					
Note 2: OCNG is	s applied only w	ithin LAA burst.				

8.4.3.1 Transmit diversity performance

8.4.3.1.1 FDD Pcell (FDD single carrier)

8.4.3.1.1.1 Minimum Requirement 2 Tx Antenna Port

The average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.3.1.1.1-2 for Pcell and in Table 8.4.3.1.1.1-3 for LAA Scell(s), with the addition of the parameters in Table 8.4.3-1, and Table 8.4.3.1.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.3.1.1.1-1: Test Parameters for LAA Scell(s)

Parameter	Unit	Value
DMTC Periodicity	ms	80
dmtc-PeriodOffset-r12 ms80- r12		0
Downlink Burst transmission pattern for LAA SCell		As specified in B.8
The number of subframes set (S ₁) in a burst		{1,3, 5, 8}
Uniform random number (p) in the burst model		0.5
Occupied OFDM symbols set in the last subframe		{6, 9, 12,14}
timing error relative of LAA SCell to PCell	μs	15
Frequency offset of th <i>i</i> -th LAA SCell relative to PCell	Hz	200

Note 1: The same PDSCH transmission mode is applied to each component carrier.

Note 2: The OCNG shall be applied for the non-scheduled OFDM symbols within the burst, and which OFDM symbols are scheduled within the burst is according to UE capability.

Table 8.4.3.1.1.1-2: Single carrier performance for CCs which are not LAA Scells for multiple CA configurations

Test	Bandwi	Aggrega	Reference	OCNG	Propagation	Antenna	Refe	rence value
number	dth	tion level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm- dsg (%)	SNR (dB)
1	10 MHz	4 CCE	R.16 FDD	OP.1 TDD	EVA5	2 x 2 Low	1	-0.6

Table 8.4.3.1.1.1-3: Single carrier performance for LAA Scell(s) for multiple CA configurations

Test	Bandwidth	Aggregati	Reference	OCNG	Propagation	Antenna	Refere	ence value
number		on level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm- dsg (%)	SNR (dB)
1	20 MHz	4 CCE	R.3 FS3	OP.1 FS3	EVA5	2 x 2 Low	1	0.2
2	20 MHz	4 CCE	R.3 FS3	OP.1 FS3	EVA5	2 x 2 Low	1	0.2
3	20 MHz	4 CCE	R.3 FS3	OP.1 FS3	EVA5	2 x 2 Low	1	0.3
4	20 MHz	4 CCE	R.3 FS3	OP.1 FS3	EVA5	2 x 2 Low	1	0.1

Note1: UE is required to fulfill only one test among test 1-4 depending on it's capability for endingDwPTS and secondSlotStartingPosition. For UE don't support endingDwPTS and secondSlotStartingPosition, it is required to fulfill test 1; For UE don't support endingDwPTS and support secondSlotStartingPosition, it is required to fulfill test 2; For UE support endingDwPTS and don't support secondSlotStartingPosition, it is required to fulfill test 3; and for UE support both endingDwPTS and secondSlotStartingPosition, it is required to fulfill test 4.

8.4.3.1.2 TDD Pcell (TDD single carrier)

8.4.3.1.2.1 Minimum Requirement 2 Tx Antenna Port

The average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.4.3.1.2.1-2 for Pcell and in Table 8.4.3.1.2.1-3 for LAA Scell(s), with the additional of the parameters in Table 8.4.3.1.2.1.1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.4.3.1.2.1-1: Test Parameters for LAA Scell(s)

Tameter Unit Value

Periodicity ms 80

Parameter	Unit	Value
DMTC Periodicity	ms	80
dmtc-PeriodOffset-r12 ms80- r12		0
Downlink Burst transmission pattern for LAA SCell		As specified in B.8
The number of subframes set (S_1) in a burst		{1,3, 5, 8}
Uniform random number (p) in the burst model		0.5
subframeStartPosition		's07'
Occupied OFDM symbols set in the last subframe		{6, 9, 12,14}
timing error relative of LAA SCell to PCell	μs	15
Frequency offset of th <i>i</i> -th LAA SCell relative to PCell	Hz	200

Note 1: The same PDSCH transmission mode is applied to each component carrier.

Note 2: The OCNG shall be applied for the non-scheduled OFDM symbols within the burst, and which OFDM symbols are scheduled within the burst is according to UE capability.

Table 8.4.3.1.2.1-2: Single carrier performance for CCs which are not LAA Scells for multiple CA configurations

Test	Bandwi	Aggrega	Reference	OCNG	Propagation	Antenna	Reference value		
number	dth	tion level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm- dsg (%)	SNR (dB)	
1	10 MHz	4 CCE	R.16 TDD	OP.1 TDD	EVA5	2 x 2 Low	1	-0.6	

Table 8.4.3.1.2.1-3: Single carrier performance for LAA Scell(s) for multiple CA configurations

Test	Bandwidth	Aggregati	Reference	OCNG	Propagation	Antenna	Refere	nce value
number		on level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm- dsg (%)	SNR (dB)
1	20 MHz	4 CCE	R.4 FS3	OP.1 FS3	EVA5	2 x 2 Low	1	0.2
2	20 MHz	4 CCE	R.4 FS3	OP.1 FS3	EVA5	2 x 2 Low	1	0.2
3	20 MHz	4 CCE	R.4 FS3	OP.1 FS3	EVA5	2 x 2 Low	1	0.3
4	20 MHz	4 CCE	R.4 FS3	OP.1 FS3	EVA5	2 x 2 Low	1	0.1

Note 1: UE is required to fulfill only one test among test 1-4 depending on it's capability for endingDwPTS and secondSlotStartingPosition. For UE don't support endingDwPTS and secondSlotStartingPosition, it is required to fulfill test 1; For UE don't support endingDwPTS and support secondSlotStartingPosition, it is required to fulfil test 2; For UE support endingDwPTS and don't support secondSlotStartingPosition, it is required to fulfill test 3; and For UE support both endingDwPTS and secondSlotStartingPosition, it is required to fulfill test 4.

8.5 Demodulation of PHICH

The receiver characteristics of the PHICH are determined by the probability of miss-detecting an ACK for a NACK (Pm-an). It is assumed that there is no bias applied to the detection of ACK and NACK (zero-threshold delection).

Table 8.5.1-1: Test Parameters for PHICH

8.5.1 **FDD**

The parameters specified in Table 8.5.1-1 are valid for all FDD tests unless otherwise stated.

Single antenna Unit **Parameter** port

Transmit diversity PDCCH_RA PHICH_RA dΒ 0 -3 OCNG_RA Downlink power allocation PCFICH_RB -3 PDCCH_RB 0 dB PHICH_RB OCNG_RB PHICH duration Normal Normal PHICH Ng (Note 1) Ng = 1Ng = 1UL Grant should be included with the **PDCCH Content** proper information aligned with A.3.6. Unused RE-s and PRB-s OCNG OCNG Cell ID 0 0 N_{oc} at antenna port dBm/15kHz -98 -98 Cyclic prefix Normal Normal according to Clause 6.9 in TS 36.211 [4] Note 1:

8.5.1.1 Single-antenna port performance

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Reference value		
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)	
1	10 MHz	R.18	OP.1 FDD	ETU70	1 x 2 Low	0.1	5.5	
2	10 MHz	R.24	OP.1 FDD	ETU70	1 x 2 Low	0.1	0.6	

8.5.1.2 Transmit diversity performance

8.5.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.2.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value			
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)			
1	10 MHz	R.19	OP.1 FDD	EVA70	2 x 2 Low	0.1	4.4			
1A	5MHz (Note 1)	R.19-1	OP.1 FDD	EVA 70	2x2 Low	0.1	4			
Note 1: Te	Note 1: Test case applicability is defined in 8.1.2.1.									

8.5.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.1.2.2-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	5 MHz	R.20	OP.1 FDD	EPA5	4 x 2 Medium	0.1	6.1

8.5.1.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3. In Table 8.5.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.5.1.2.3-1: Test Parameters for PHICH

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Paramete	er	Unit	Cell 1	Cell 2
Downlink power allocation	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
N_{oc} at antenna port	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.5.1.2.3-2	1.5
BW _{Channe}	I	MHz	10	10
Subframe Config	guration		Non-MBSFN	Non-MBSFN
Time Offset between	een Cells	μs	2.5 (synchror	nous cells)
Cell Id			0	1
ABS pattern (N	lote 4)		N/A	00000100 00000100 00000100 01000100 00000100
RLM/RRM Measurem Pattern (Not			00000100 00000100 00000100 00000100 00000100	N/A
CSI Subframe Sets (Note 6)	Ccsi,0		00000100 00000100 00000100 01000100 00000100	N/A
	C _{CSI,1}		11111011 11111011 11111011 10111011 11111011	N/A
Number of control OFDM symbols			3	3
PHICH Ng (N	ote 9)		1	N/A
PHICH dura	tion		extended	N/A
Unused RE-s and			OCNG	OCNG
Cyclic pref	ix		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in the 26th subframe indicated by the ABS pattern.
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test.
- Note 9: According to Clause 6.9 in TS 36.211 [4]

Table 8.5.1.2.3-2: Minimum performance PHICH

Test Number	Reference Channel			Propagation Conditions (Note 1)		Conditions		Antenna Configuration and	Refere	nce Value
		Cell 1	Cell 2	Cell 1	Cell 2	Correlation Matrix	Pm-an (%)	SNR (dB) (Note 2)		
1	R.19	OP.1 FDD	OP.1 FDD	EPA5	EPA5	2x2 Low	0.1	4.6		
Note 1:					ell 2 are s	tatistically indepen	dent.			
Note 2:	SNR corresponds to \widehat{E}_s/N_{oc2} of cell 1.									
Note 3:	The correlation	matrix an	nd antenna	a configur	ation appl	y for Cell 1 and Ce	II 2.			

8.5.1.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.4-2. In Table 8.5.1.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.5.1.2.4-1: Test Parameters for PHICH

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
	N_{oc1}	dBm/15kHz	-98 (Note 1)	N/A	N/A
N_{oc} at antenna	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	N_{oc3}	dBm/15kHz	-93 (Note 3)	N/A	N/A
\hat{E}_s/N		dB	Reference Value in Table 8.5.1.2.4-	5	3
BWch	annel	MHz	10	10	10
Subframe Co	onfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset be	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cell	Id		0	126	1
PDCCH (PDCCH Content		UL Grant should be included with the proper information aligned with A.3.6.	N/A	N/A
ABS pattern	n (Note 4)		N/A	00000100 00000100 00000100 00000100 00000100	00000100 00000100 00000100 00000100 00000100
RLM/RRM Me Subframe Patt			00000100 00000100 00000100 00000100 00000100	N/A	N/A
CSI Subframe	Ccsi,o		00000100 00000100 00000100 00000100 00000100	N/A	N/A
Sets (Note 6)	Ccsi,1		11111011 11111011 11111011 11111011 11111011	N/A	N/A
Number of control OFDM symbols			2	Note 7	Note 7
PHICH Ng			1	N/A	N/A
PHICH d			Normal	N/A	N/A
Unused RE-s Cyclic p			OCNG Normal	OCNG Normal	OCNG Normal
Cyclic	JI GIIA		inoillai	inoilliai	inuillai

Note 1:	This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
Note 2:	This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
Note 3:	This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
Note 4:	ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in the 26 th subframe indicated by the ABS pattern.
Note 5:	Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
Note 6:	As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
Note 7:	The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
Note 8:	The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.

SIB-1 will not be transmitted in Cell 2 and Cell 3 in the test

According to Clause 6.9 in TS 36.211 [4].

Test Number	Reference Channel	OC	OCNG Pattern		Propagation Conditions (Note 1)		Antenna Configuration	Refere	ence Value	
		Cell 1	Cell 2	Cell 3	Cell 1 Cell 2 Cell 3		and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)	
1	R.19									5.0
Note 1: Note 2:	Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.									

Table 8.5.1.2.4-2: Minimum performance PHICH

Note 3: SNR corresponds to E_s/N_{oc2} of Cell 1.

Note 9:

Note 10:

8.5.1.2.5 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Ports under Asynchronous Network

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.5-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.5-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells and applying interference model defined in clause B.5.2. In Table 8.5.1.2.5-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is not provided.

Table 8.5.1.2.5-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3	
	PDCCH_RA PHICH_RA PDSCH_RA OCNG_RA	dB	-3	-3	-3	
Downlink power allocation	PCFICH_RB PHICH_RB PDCCH_RB PDSCH_RB OCNG_RB	dB	-3	-3	-3	
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
N_{oc} at antenna port	dBm/15kHz	-98				
\hat{E}_s/N_{oc}	dB	N/A	13.91	3.34		
BW _{Channel}		MHz	10	10	10	
Cyclic Prefix			Normal	Normal	Normal	
Cell ID			0	1	6	
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN	
Number of control OFDM sy	mbols		1	1	1	
PHICH Ng (Note 1)			1	N/A	N/A	
PHICH duration			Normal	N/A	N/A	
Interference model			N/A	As specified in clause B.5.2	As specified in clause B.5.2	
Probability of occurrence of	Rank 1	%	N/A	80	80	
PDSCH transmission rank in interfering cells	Rank 2	%	N/A	20	20	
Unused RE-s and PRB-s		OCNG	OCNG	OCNG		
Time offset relative to Cell 1	ms	N/A 0.33		0.67		
Frequency offset relative to	Cell 1	Hz	N/A	0	0	
Note 1: According to Clau	use 6.9 in TS 36.	211 [4].				

Table 8.5.1.2.5-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test Number	Reference Channel	00	NG Patt	ern		Propagation Conditions (Note 1)		Antenna Configuration	Reference Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EVA7 0	EVA7 0	EVA7 0	2x2 Low	0.1	17.9
Note 1: Note 2: Note 3:	Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.									

8.5.1.2.6 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Ports with Non-Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.6-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.6-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the non-colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.1.2.6-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the agressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.1.2.6-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3			
	PDCCH_RA OCNG_RA	dB	-3	-3	-3			
	PHICH_RA	dB	-3	N/A	N/A			
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3 -3		-3			
	PHICH_RB	dB	-3	N/A	N/A			
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1			
N_{oc} at antenna port	N_{oc} at antenna port			-98				
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34			
BW _{Channel}		MHz	10	10	10			
Cyclic Prefix			Normal	Normal	Normal			
Cell ID			0	1	6			
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN			
Number of control OFDM sy	mbols		1	1	1			
PHICH Ng (Note 1)			1	N/A	N/A			
PHICH duration			Normal	N/A	N/A			
Interference model		N/A	As specified in clause B.7.1	As specified in clause B.7.1				
Unused RE-s and PRB-s (N		OCNG	OCNG	OCNG				
Time offset to cell 1	us	N/A 2		3				
Frequency offset to cell 1	· · · · · · · · · · · · · · · · · · ·	Hz	N/A	200	300			
Note 1: According to Clar	use 6.9 in TS 36.3	211 [4].						

For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.5.1.2.6-2: Minimum performance PHICH for Enhanced Downlink Control Channel **Performance Requirement Type A**

Test Number	Reference Channel	OC	NG Patte	ern	Propagation Conditions (Note 1)		. •		Reference Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	0.1	15.8

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 1:

The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 2:

SNR corresponds to \hat{E}_s/N_{oc2} of Cell 1 as defined in clause 8.1.1. Note 3:

8.5.1.2.7 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Ports with Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.7-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.7-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.1.2.7-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.1.2.7-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3	
	PDCCH_RA OCNG_RA	dB	-3	-3	-3	
	PHICH_RA	dB	-3	N/A	N/A	
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3 -3		
	PHICH_RB	dB	-3	N/A	N/A	
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1	
N_{oc} at antenna port	dBm/15kHz	-98				
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34	
BW _{Channel}		MHz	10	10	10	
Cyclic Prefix			Normal	Normal	Normal	
Cell ID			0	6	1	
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN	
Number of control OFDM sy	mbols		1	1	1	
PHICH Ng (Note 1)			1	N/A	N/A	
PHICH duration			Normal	N/A	N/A	
Interference model		N/A	As specified in clause B.7.1	As specified in clause B.7.1		
Unused RE-s and PRB-s (N		OCNG	OCNG	OCNG		
Time offset to cell 1		us	N/A	2	3	
Frequency offset to cell 1	·	Hz	N/A	200	300	
Note 1: According to Clar	use 6.9 in TS 36.	211 [4].				

Table 8.5.1.2.7-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type B

For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Test Number	Reference Channel	OC	NG Patte	ern	Propagation Conditions (Note 1)		Antenna Configuration	Reference Value		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	0.1	13.4
Note 1: Note 2: Note 3:	Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 2: The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.									

8.5.1.2.8 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Ports with Non-Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.1-1 and Table 8.5.1.2.8-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.1.2.8-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the non-colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.1.2.8-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.1.2.8-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3			
	PDCCH_RA OCNG_RA	dB	-3	-3	-3			
	PHICH_RA	dB	-3	N/A	N/A			
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3			
	PHICH_RB	dB	-3	N/A	N/A			
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1			
N_{oc} at antenna port	N_{oc} at antenna port			-98				
\hat{E}_s/N_{oc}		dB	N/A	N/A 13.91				
BW _{Channel}		MHz	10	10	10			
Cyclic Prefix			Normal	Normal	Normal			
Cell ID			0	1	6			
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN			
Number of control OFDM sy	mbols		1	1	1			
PHICH Ng (Note 1)			1	N/A	N/A			
PHICH duration			Normal	N/A	N/A			
Interference model		N/A	As specified in clause B.7.1	As specified in clause B.7.1				
Unused RE-s and PRB-s (N		OCNG	OCNG	OCNG				
Time offset to cell 1		us	N/A	2	3			
Frequency offset to cell 1		Hz	N/A	200	300			
Note 1: According to Clar	use 6.9 in TS 36.	211 [4].	·					

For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs. Note 2:

Table 8.5.1.2.8-2: Minimum performance PHICH for Enhanced Downlink Control Channel **Performance Requirement Type B**

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions (Note 1)			Antenna Configuration	Refere	ence Value	
		Cell 1	Cell 2	Cell 3	Cell 1 Cell 2 Cell 3		and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)	
1	R.19	OP.1 FDD	OP.1 FDD	OP.1 FDD	EPA5	EPA5	EPA5	2x2 Low	0.1	15.0

The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. Note 1:

The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. Note 2:

SNR corresponds to \hat{E}_s/N_{oc2} of Cell 1 as defined in clause 8.1.1. Note 3:

8.5.2 **TDD**

The parameters specified in Table 8.5.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.5.2-1: Test Parameters for PHICH

Param	eter	Unit	Single antenna port	Transmit diversity
Uplink downlink cor 1)	nfiguration (Note		1	1
Special subframe (Note	•		4	4
	PDCCH_RA PHICH_RA OCNG_RA		0	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	0	-3
PHICH du	uration		Normal	Normal
PHICH Ng	(Note 3)		Ng = 1	Ng = 1
PDCCH C	Content			I be included with the on aligned with A.3.6.
Unused RE-s	and PRB-s		OCNG	OCNG
Cell I	D		0	0
$N_{\it oc}$ at ante	nna port	dBm/15kHz	-98	-98
Cyclic p			Normal	Normal
ACK/NACK fee			Multiplexing	Multiplexing
Note 1: as specif	ied in Table 4.2-2	in TS 36.211 [4]	

Note 1: as specified in Table 4.2-2 in TS 36.211 [4]
Note 2: as specified in Table 4.2-1 in TS 36.211 [4]
Note 3: according to Clause 6.9 in TS 36.211 [4]

8.5.2.1 Single-antenna port performance

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Reference value	
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.18	OP.1 TDD	ETU70	1 x 2 Low	0.1	5.8
2	10 MHz	R.24	OP.1 TDD	ETU70	1 x 2 Low	0.1	1.3

8.5.2.2 Transmit diversity performance

8.5.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.2.1-1: Minimum performance PHICH

Ī	Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
	number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
ſ	1	10 MHz	R.19	OP.1 TDD	EVA70	2 x 2 Low	0.1	4.2

8.5.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.5.2.2.2-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	5 MHz	R.20	OP.1 TDD	EPA5	4 x 2 Medium	0.1	6.2

8.5.2.2.3 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.3-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.2 and Annex C.3.3, In Table 8.5.2.2.3-1, Cell 1 is the serving cell, and Cell 2 is the aggressor cell. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 is according to Annex C.3.3, respectively.

Table 8.5.2.2.3-1: Test Parameters for PHICH

Paramete	r	Unit	Cell 1	Cell 2
Uplink downlink cor	nfiguration		1	1
Special subframe co	onfiguration		4	4
Downlink nower	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3
Downlink power allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3
	N_{oc1}	dBm/15kHz	-100.5 (Note 1)	N/A
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A
	N_{oc3}	dBm/15kHz	-95.3 (Note 3)	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 8.5.2.2.3-2	1.5
BW _{Channel}	l	MHz	10	10
Subframe Confiç	guration		Non-MBSFN	Non-MBSFN
Time Offset between	een Cells	μs	2.5 (synchronous cells)	
Cell Id			0	1
ABS pattern (N	ote 4)		N/A	0000010001 0000000001
RLM/RRM Measureme Pattern (Note			000000001 000000001	N/A
CSI Subframe Sets	C _{CSI,0}		0000010001 0000000001	N/A
(Note 6)	C _{CSI,1}		1100101000 1100111000	N/A
Number of control OFDM symbols			3	3
ACK/NACK feedback mode			Multiplexing	N/A
PHICH Ng (Note 9)			1	N/A
PHICH duration			extended	N/A
Unused RE-s and			OCNG	OCNG
Cyclic pref	ix		Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in subframe 5
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 7: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 8: SIB-1 will not be transmitted in Cell2 in the test.
- Note 9: According to Clause 6.9 in TS 36.211 [4]

Table 8.5.2.2.3-2: Minimum performance PHICH

Test Number	Reference Channel	OCNG	Pattern	rn Propagation Conditions (Note 1)		Antenna Configuration and	Reference Value		
		Cell 1	Cell 2	Cell 1	Cell 2	Correlation Matrix	Pm-an (%)	SNR (dB) (Note 2)	
1	R.19	OP.1 TDD	OP.1 TDD	EPA5	EPA5	2x2 Low	0.1	4.6	
Note 1:					ell 2 are s	tatistically independ	dent.		
Note 2:	SNR correspor	orresponds to \widehat{E}_s/N_{oc2} of cell 1.							
Note 3:	The correlation	matrix ar	nd antenna	a configur	ation appl	y for Cell 1 and Ce	II 2.		

8.5.2.2.4 Minimum Requirement 2 Tx Antenna Port (demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are configured)

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.4-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.4-2. In Table 8.5.2.2.4-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.5.2.2.4-1: Test Parameters for PHICH

Paran	neter	Unit	Cell 1	Cell 2	Cell 3
Uplink downlinl	configuration		1	1	1
Special subfram	e configuration		4	4	4
Downlink power	PDCCH_RA PHICH_RA OCNG_RA	dB	-3	-3	-3
allocation	PCFICH_RB PDCCH_RB PHICH_RB OCNG_RB	dB	-3	-3	-3
	N_{oc1}	dBm/15kHz	-98 (Note 1)	N/A	N/A
N _{oc} at antenna	N_{oc2}	dBm/15kHz	-98 (Note 2)	N/A	N/A
port	N_{oc3}	dBm/15kHz	-93 (Note 3)	N/A	N/A
\hat{E}_s/l		dB	Reference Value in Table 8.5.2.2.4-2	5	3
BWc	nannel	MHz	10	10	10
Subframe C	onfiguration		Non-MBSFN	Non-MBSFN	Non- MBSFN
Time Offset b	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cel	l ld		0	126	1
PDCCH	Content		UL Grant should be included with the proper information aligned with A.3.6.	N/A	N/A
ABS patter	n (Note 4)		N/A	0000000001 0000000001	0000000001
RLM/RRM Measu Pattern			000000001 000000001	N/A	N/A
CSI Subframe	Ccsi,0		000000001 000000001	N/A	N/A
Sets (Note 6)	C _{CSI,1}		1100111000 1100111000	N/A	N/A
Number of contro	OFDM symbols		2	Note 7	Note 7
ACK/NACK feedback mode			Multiplexing	N/A	N/A
PHICH Ng			1	N/A	N/A
PHICH (Normal	N/A	N/A
Unused RE-s			OCNG	OCNG	OCNG
Cyclic			Normal	Normal	Normal

- Note 1: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 2: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 3: This noise is applied in OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 4: ABS pattern as defined in [9]. PHICH is transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell but not in subframe 5
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 7: The number of control OFDM symbols is not available for ABS and is 2 for the subframe indicated by "0" of ABS pattern.
- Note 8: The number of the CRS ports in Cell 1, Cell 2 and Cell 3 is the same.
- Note 9: SIB-1 will not be transmitted in Cell 2 and Cell 3 in the test.
- Note 10: According to Clause 6.9 in TS 36.211 [4]

Table 8.5.2.2.4-2: Minimum performance PHICH

Test Number	Reference Channel	oc	NG Patt	ern	Propagation Conditions (Note 1)		Antenna Configuration	Refere	ence Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 TDD	OP.1 TDD	OP.1 TDD	EPA5	EVA5	EVA5	2x2 Low	0.1	5.7
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. SNR corresponds to $\hat{E}_{\rm s}/N_{\rm ec2}$ of Cell 1.									

8.5.2.2.5 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Ports with Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.5-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.5-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.2.2.5-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.2.2.5-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3		
Uplink downlink configuration	n		1	1	1		
Special subframe configuration	tion		4	4	4		
	PDCCH_RA OCNG_RA	dB	-3	-3	-3		
	PHICH_RA	dB	-3	N/A	N/A		
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3		
	PHICH_RB	dB	-3	N/A	N/A		
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
N_{oc} at antenna port		dBm/15kHz	-98				
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34		
BW _{Channel}		MHz	10	10	10		
Cyclic Prefix			Normal	Normal	Normal		
Cell ID			0	6	1		
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN		
Number of control OFDM sy	mbols		1	1	1		
PHICH Ng (Note 1)			1	N/A	N/A		
PHICH duration			Normal	N/A	N/A		
Interference model			N/A	As specified in clause B.7.1	As specified in clause B.7.1		
Unused RE-s and PRB-s (N		OCNG	OCNG	OCNG			
Time offset to cell 1	us	N/A	2	3			
Frequency offset to cell 1		Hz	N/A	200	300		
Note 1: According to Clar	use 6.9 in TS 36.	211 [4].					

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.5.2.2.5-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test	Reference	OCNG Pattern		Pı	ropagatio	on	Antenna	Reference Value		
Number	Channel				Cond	Conditions (Note 1)		Configuration		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation	Pm-an	SNR (dB)
								Matrix (Note 2)	(%)	(Note 3)
1	R.19	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 Low	0.1	16.2
		TDD	TDD	TDD						
Note 1:	The propagation	n conditio	ns for Ce	II 1, Cell	2 and Ce	ll 3 are s	tatistically	/ independent.		
Note 2:		orrelation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.								
Note 3:	SNR correspond	ds to $\widehat{E}_{arepsilon}$ /	N_{ac2} of C	Cell 1 as	defined ir	n clause 8	3.1.1.			

8.5.2.2.6 Enhanced Downlink Control Channel Performance Requirement Type A - 2 Tx Antenna Ports with Non-Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.6-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.6-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the non-colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.2.2.6-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.2.2.6-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3			
Uplink downlink configuration	n		1	1	1			
Special subframe configuration	tion		4	4	4			
	PDCCH_RA OCNG_RA	dB	-3	-3	-3			
	PHICH_RA	dB	-3	N/A	N/A			
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3			
	PHICH_RB	dB	-3	N/A	N/A			
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1			
N_{oc} at antenna port		dBm/15kHz		-98				
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34			
BW _{Channel}		MHz	10 10		10			
Cyclic Prefix			Normal	Normal	Normal			
Cell ID			0	1	6			
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN			
Number of control OFDM sy	mbols		1	1	1			
PHICH Ng (Note 1)			1	N/A	N/A			
PHICH duration			Normal	N/A	N/A			
Interference model		N/A	As specified in clause B.7.1	As specified in clause B.7.1				
Unused RE-s and PRB-s (N		OCNG	OCNG	OCNG				
Time offset to cell 1	us	N/A	2	3				
Frequency offset to cell 1		Hz	N/A	200	300			
Note 1: According to Clar								

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.5.2.2.6-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type A

Test	Reference	OCNG Pattern		Pı	ropagation	on	Antenna	Refere	ence Value	
Number	Channel				Cond	Conditions (Note 1)		Configuration		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation	Pm-an	SNR (dB)
								Matrix (Note 2)	(%)	(Note 3)
1	R.19	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 Low	0.1	16.1
		TDD	TDD	TDD						
Note 1:	The propagation	n conditio	ns for Ce	II 1, Cell	2 and Ce	II 3 are s	tatistically	/ independent.		
Note 2:	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.									
Note 3:	SNR correspond	ds to $\widehat{E}_{arepsilon}$ /	N_{ac2} of C	Cell 1 as	defined ir	n clause 8	3.1.1.			

8.5.2.2.7 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Ports with Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.7-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.7-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.2.2.7-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.2.2.7-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3				
Uplink downlink configuration	n		1	1	1				
Special subframe configuration	tion		4	4	4				
	PDCCH_RA OCNG_RA	dB	-3	-3	-3				
	PHICH_RA	dB	-3	N/A	N/A				
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3				
	PHICH_RB	dB	-3	N/A	N/A				
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1				
N_{oc} at antenna port		dBm/15kHz		-98					
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34				
BW _{Channel}		MHz	10	10	10				
Cyclic Prefix			Normal	Normal	Normal				
Cell ID			0	6	1				
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN				
Number of control OFDM sy	mbols		1	1	1				
PHICH Ng (Note 1)			1	N/A	N/A				
PHICH duration			Normal	N/A	N/A				
Interference model		N/A	As specified in clause B.7.1	As specified in clause B.7.1					
Unused RE-s and PRB-s (Note 2)			OCNG	OCNG	OCNG				
Time offset to cell 1	us	N/A 2		3					
Frequency offset to cell 1	Hz	N/A	200	300					
	Note 1: According to Clause 6.9 in TS 36.211 [4].								

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.5.2.2.7-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test	Reference	OCNG Pattern		P	ropagation	on	Antenna	Refere	ence Value	
Number	Channel				Cond	Conditions (Note 1)		Configuration		
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation	Pm-an	SNR (dB)
								Matrix (Note 2)	(%)	(Note 3)
1	R.19	OP.1	OP.1	OP.1	EPA5	EPA5	EPA5	2x2 Low	0.1	14.0
		TDD	TDD	TDD						
Note 1:	The propagation	n conditio	ns for Ce	II 1, Cell	2 and Ce	II 3 are s	tatistically	/ independent.		
Note 2:	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.									
Note 3:	SNR correspond	ds to $\hat{E}_{arepsilon}$ /	N_{oc2} of 0	Cell 1 as	defined ir	n clause 8	3.1.1.			

8.5.2.2.8 Enhanced Downlink Control Channel Performance Requirement Type B - 2 Tx Antenna Ports with Non-Colliding CRS Dominant Interferer

For the parameters specified in Table 8.5.2-1 and Table 8.5.2.2.8-1, the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.5.2.2.8-2. The purpose of this test is to verify the PHICH performance with 2 transmit antennas when the serving cell PHICH transmission is interfered by two interfering cells with the dominant interferer having the non-colliding CRS pattern and applying interference model defined in clause B.7.1. In Table 8.5.2.2.8-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.5.2.2.8-1: Test Parameters for PHICH

Parameter		Unit	Cell 1	Cell 2	Cell 3		
Uplink downlink configuration	n		1	1	1		
Special subframe configura	tion		4	4	4		
	PDCCH_RA OCNG_RA	dB	-3	-3	-3		
	PHICH_RA	dB	-3	N/A	N/A		
Downlink power allocation	PCFICH_RB PDCCH_RB OCNG_RB	dB	-3	-3	-3		
	PHICH_RB	dB	-3	N/A	N/A		
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
N_{oc} at antenna port		dBm/15kHz		-98			
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34		
BW _{Channel}		MHz	10	10	10		
Cyclic Prefix			Normal	Normal	Normal		
Cell ID			0	1	6		
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN		
Number of control OFDM sy	mbols		1	1	1		
PHICH Ng (Note 1)			1	N/A	N/A		
PHICH duration			Normal	N/A	N/A		
Interference model		N/A	As specified in clause B.7.1	As specified in clause B.7.1			
Unused RE-s and PRB-s (N		OCNG	OCNG	OCNG			
Time offset to cell 1	us	N/A	2	3			
Frequency offset to cell 1	Hz	N/A	200	300			
Note 1: According to Cla			not include control	rogion PEo			

Note 2: For Cell 2 and Cell 3 unused RE-s and PRB-s do not include control region REs.

Table 8.5.2.2.8-2: Minimum performance PHICH for Enhanced Downlink Control Channel Performance Requirement Type B

Test Number	Reference Channel	OC	NG Patt	NG Pattern Propagation Antenna Conditions (Note 1)		. 0		Refere	ence Value	
		Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-an (%)	SNR (dB) (Note 3)
1	R.19	OP.1 TDD	OP.1 TDD	OP.1 TDD	EPA5	EPA5	EPA5	2x2 Low	0.1	15.5
Note 1: Note 2: Note 3:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent. The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3. SNR corresponds to \hat{E}_s/N_{oc2} of Cell 1 as defined in clause 8.1.1.									

8.6 Demodulation of PBCH

The receiver characteristics of the PBCH are determined by the probability of miss-detection of the PBCH (Pm-bch), which is defined as

$$Pm - bch = 1 - \frac{A}{B}$$

Where A is the number of correctly decoded MIB PDUs and B is the Number of transmitted MIB PDUs (Redundancy versions for the same MIB are not counted separately).

8.6.1 FDD

Table 8.6.1-1: Test Parameters for PBCH

Parame	ter	Unit	Single antenna port	Transmit diversity	
Downlink power	Downlink power PBCH_RA allocation PBCH_RB		0	-3	
allocation			0	-3	
$N_{\it oc}$ at anter	na port	dBm/15kHz	-98	-98	
Cyclic pr	efix		Normal	Normal	
Cell II)		0	0	
Note 1: as specified in Table 4.2-2 in TS 36.211 [4] Note 2: as specified in Table 4.2-1 in TS 36.211 [4]					

8.6.1.1 Single-antenna port performance

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detecting PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.1-1: Minimum performance PBCH

I	Test	Bandwidth	Reference	Propagation	Antenna	Reference value		
	number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)	
					and			
					correlation			
					Matrix			
	1	1.4 MHz	R.21	ETU70	1 x 2 Low	1	-6.1	

8.6.1.2 Transmit diversity performance

8.6.1.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.2.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)
1	1.4 MHz	R.22	EPA5	2 x 2 Low	1	-4.8

8.6.1.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.1.2.2-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Reference value		
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)	
				and			
				correlation			
				Matrix			
1	1.4 MHz	R.23	EVA5	4 x 2 Medium	1	-3.5	

8.6.1.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.1.2.3-1 and Table 8.6.1.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.1.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, repectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.6.1.2.3-1: Test Parameters for PBCH

Param	eter	Unit	Cell 1	Cell 2	Cell 3
Downlink power	PBCH_RA OCNG_RA	dB	-3	-3	-3
allocation	PBCH_RB OCNG_RB	dB	-3	-3	-3
N_{oc} at ante	enna port	dBm/15kHz	-98	N/A	N/A
$\frac{\hat{E}_3}{N_{ac}}$		dB	Reference Value in Table 8.6.1.2.3-2	4	2
BWch	annel	MHz	1.4	1.4	1.4
Time Offset be	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cell	Id		0	126	1
ABS Patteri	n (Note 4)		N/A	01000000 01000000 01000000 01000000 01000000	01000000 01000000 01000000 01000000 01000000
Unused RE-s and PRB-s			OCNG	OCNG	OCNG
Cyclic	orefix		Normal	Normal	Normal

Note 1: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.

Note 2: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.

Note 3: The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.

Note 4: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Table 8.6.1.2.3-2: Minimum performance PBCH

Test	Reference	Propagation Conditions (Note 1)		Antenna Configuration	Refe	rence Value		
Number	Channel	Cell 1	Cell 2	Cell 3	and Correlation Matrix (Note 2)	Pm-bch (%)	SNR (dB) (Note 3)	
1	R.22	ETU30	ETU30	ETU30	2x2 Low	1	-3.0	
Note 1:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.							
Note 2:	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.							
Note 3:	SNR correspon	nds to \hat{E}_s/N_o	$_{c}$ of cell 1.					

8.6.2 TDD

Table 8.6.2-1: Test Parameters for PBCH

Parame	ter	Unit	Single antenna port	Transmit diversity
Uplink downlink o			1	1
Special subframe (Note 2	•		4	4
Downlink power	PBCH_RA	dB	0	-3
allocation	PBCH_RB	dB	0	-3
N_{oc} at anter	na port	dBm/15kHz	-98	-98
Cyclic pr	efix		Normal	Normal
Cell II)		0	0
		2-2 in TS 36.211 [4 2-1 in TS 36.211 [4		

8.6.2.1 Single-antenna port performance

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.1-1: Minimum performance PBCH

Ī	Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
	number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
					and		
					correlation		
					Matrix		
ſ	1	1.4 MHz	R.21	ETU70	1 x 2 Low	1	-6.4

8.6.2.2 Transmit diversity performance

8.6.2.2.1 Minimum Requirement 2 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.2.1-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation		
				Matrix		
1	1.4 MHz	R.22	EPA5	2 x 2 Low	1	-4.8

8.6.2.2.2 Minimum Requirement 4 Tx Antenna Port

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.6.2.2.2-1: Minimum performance PBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
numbe	•	Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
				and		
				correlation Matrix		
1	1.4 MHz	R.23	EVA5	4 x 2 Medium	1	-4.1

8.6.2.2.3 Minimum Requirement 2 Tx Antenna Port under Time Domain Measurement Resource Restriction with CRS Assistance Information

For the parameters specified in Table 8.6.2.2.3-1 and Table 8.6.2.2.3-2, the averaged probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.6.2.2.3-2. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 8.6.2.2.3-1: Test Parameters for PBCH

Parameter		Unit	Cell 1	Cell 2	Cell 3
Downlink power	PBCH_RA OCNG_RA	dB	-3	-3	-3
allocation	PBCH_RB OCNG_RB	dB	-3	-3	-3
N_{oc} at ante	enna port	dBm/15kHz	-98	N/A	N/A
$\frac{\widehat{E}_s}{N_{oc}}$,	dB	Reference Value in Table 8.6.2.2.3-2	4	2
BWChannel		MHz	1.4	1.4	1.4
Time Offset be	etween Cells	μs	N/A	3	-1
Frequency shift	between Cells	Hz	N/A	300	-100
Cell	ld		0	126	1
ABS Patterr	n (Note 4)		N/A	0000000001 0000000001	0000000001 0000000001
Unused RE-s	and PRB-s		OCNG	OCNG	OCNG
Cyclic p	orefix		Normal	Normal	Normal

Note 1: The number of the CRS ports in Cell1, Cell2 and Cell 3is the same.

Note 2: SIB-1 will not be transmitted in Cell2 and Cell 3 in the test.

Note 3: The PBCH transmission from Cell 1, Cell 2 and Cell 3 overlap. The same PBCH transmission redundancy version is used for Cell 1, Cell 2 and Cell 3.

Note 4: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.

Table 8.6.2.2.3-2: Minimum performance PBCH

Test	Reference	Propagation Conditions (Note 1)			Antenna Configuration	Reference Value	
Number	Channel	Cell 1	Cell 2	Cell 3	and Correlation Matrix	Pm-bch	SNR (dB) (Note
					(Note 2)	(%)	3)
1	R.22	ETU30	ETU30	ETU30	2x2 Low	1	-3.0
Note 1:	The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.						
Note 2:	The correlation matrix and antenna configuration apply for Cell 1, Cell 2 and Cell 3.						

Note 3: SNR corresponds to \hat{E}_s/N_{oc} of cell 1.

8.7 Sustained downlink data rate provided by lower layers

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum number of DL-SCH transport block bits received within a TTI for the UE category indicated. The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement. The size of the TB per TTI corresponds to the largest possible DL-SCH transport block for each UE category using the maximum number of layers for spatial multiplexing. Transmission modes 1 and 3 are used with radio conditions resembling a scenario where sustained maximum data rates are available.

Test case is selected according to table 8.7-1 depending on UE capability for CA and EPDCCH.

Single carrier UE Single carrier UE CA UE not **CA UE supporting** not supporting supporting supporting **EPDCCH EPDCCH EPDCCH EPDCCH FDD** 8.7.1 8.7.1 8.7.3 8.7.1, 8.7.3 **TDD** 8.7.4 8.7.2, 8.7.4 8.7.2 8.7.2

Table 8.7-1: SDR test applicability

8.7.1 FDD (single carrier and CA)

The parameters specified in Table 8.7.1-1 are valid for all FDD tests unless otherwise stated.

Parameter	Unit	Value
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,0,1,2} for 64QAM and 256QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1
Cross carrier scheduling		Not configured
Propagation condition		Static propagation condition No external noise sources are applied

Table 8.7.1-1: Common Test Parameters (FDD)

For UE not supporting 256QAM, the requirements are specified in Table 8.7.1-3, with the addition of the parameters in Table 8.7.1-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.1-4. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.1-6, with the addition of the parameters in Table 8.7.1-5 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.1-7, the TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirement in Table 8.7.1-3 is not applicable.

For UE supporting 256QAM and category 9/10 and category 13, the requirements are specified in both Table 8.7.1-3 and Table 8.7.1-6, with the addition of the parameters in Table 8.7.1-2 and in Table 8.7.1-5 respectively. The downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.1-4 and in Table 8.7.1-7 for the category 9/10 and category 13, the TB success rate shall be sustained during at least 300 frames.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.1-2: test parameters for sustained downlink data rate (FDD 64QAM)

	Bandwidth	Transmission	Antenna	Codebook subset	Dow allo	nlink p	ower (dB)	$\hat{E}_{\scriptscriptstyle s}$ at	Symbols for
Test	(MHz)	mode	configuration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	antenna port (dBm/15kHz)	unused PRBs
1	10	1	1 x 2	N/A	0	0	0	-85	OP.6 FDD
2	10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3,4,6	20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3A	10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3B, 4A	2x10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3C, 4B	15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6A	2x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6B	10+15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6C	10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6D	15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6E	2x15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6F	15+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6G	20+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7	3x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7A	15+20+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7B	10+20+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7C	15+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7D	10+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7E	10+10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7F	10+15+15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7G	5+10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7H	5+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
71	5+10+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8	4x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8A	20+20+20+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8B	20+20+10+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8C	20+20+10+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8D	20+10+10+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
9	5x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD

NOTE 1: For CA test cases, PUCCH format 1b with channel selection is used to feedback ACK/NACK for Test 1-6E, and PUCCH format 3 is used to feedback ACK/NACK for Test 7-7G.

Table 8.7.1-3: Minimum requirement (FDD 64QAM)

Test	Number of bits of a DL-SCH transport	Measurement channel	Reference value
	block received within a TTI		TB success rate [%]
1	10296	R.31-1 FDD	95
2	25456	R.31-2 FDD	95
3	51024	R.31-3 FDD	95
3A	36696 (Note 2)	R.31-3A FDD	85
3B	25456	R.31-2 FDD	95
3C	51024	R.31-3C FDD	85
4	75376 (Note 3)	R.31-4 FDD	85
4A	36696 (Note 2)	R.31-3A FDD	85
4B	55056 (Note 5)	R.31-4B FDD	85
6	75376 (Note 3)	R.31-4 FDD	85
6A	75376 (Note 3)	R.31-4 FDD	85
6B	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85 85
OD	55056 for 15MHz CC	R.31-5 FDD for 15MHz CC	83
6C		R.31-3A FDD for 10MHz CC	85
Ю	36696 (Note 2) for 10MHz CC		65
eD.	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	0.5
6D	55056 for 15MHz CC	R.31-5 FDD for 15MHz CC	85
<u> </u>	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	0.5
6E	55056 (Note 5) for two 15MHz CCs	R.31-4B FDD for two 15MHz CCs	85
6F	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC	85
	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC	
6G	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	85
	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC	
7	75376 (Note 3)	R.31-4 FDD	85
7A	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC	85
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
7B	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
7C	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC	85
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
7D	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85
	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC	
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
7E	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
7F	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85
	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC	
7G	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC	85
	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
7H	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC	85
	55056 (Note 5) for 15MHz CC	R.31-5 FDD for 15MHz CC	
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
71	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC	85
	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	
8	75376 (Note 3)	R.31-4 FDD	85
8A	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
8B	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	85
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
8C	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC	85
00	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	00
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
8D	18336 (Note 6) for 5MHz CC	R.31-6 FDD for 5MHz CC	85
טט	36696 (Note 2) for 10MHz CC	R.31-3A FDD for 10MHz CC	03
	75376 (Note 3) for 20MHz CC	R.31-4 FDD for 20MHz CC	
9	, ,		95
	75376 (Note 3)	R.31-4 FDD	85

Note 2: 35160 bits for sub-frame 5.

Note 3: 71112 bits for sub-frame 5.

Note 4: The TB success rate is defined as TB success rate = 100%*N_{DL_correct_rx}/ (N_{DL_newtx} + N_{DL_retx}), where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport blocks, and N_{DL_correct_rx} is the number of correctly received DL transport blocks.

Note 5: 52752bits for sub-frame 5.

Note 6: 15840bits for sub-frame 0.

Table 8.7.1-4: Test points for sustained data rate (FRC 64QAM)

CA	Maximum supported Bandwidth/	oported dwidth/ Cat 1 Cat 2 Cat 3 Cat 4 Cat 6.7		6-4-6-7	C-+ 0.40	Cat 11, 12	DL Cat.		
config	Bandwidth combination (MHz)	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 6,7	Cat. 9,10	DL Cat. 11,12	15
C:I	10	1	2	3A	3A	-	-	-	-
Single carrier	15	-	-	3C	4B	-	-	-	-
camer	20	-	-	3	4	6	-	-	-
	10+10	-	-	3B	4A	4A	4A	-	-
	10+15	-	-	3B	4A	6B	6B	-	-
	10+20	-	-	3B	4A	6C	6C	-	-
CA	15+15	-	-	3B	4A	6E	6E	-	-
with	15+5			3B	4A	6F	6F	-	-
2CCs	20+5	-	-	3	4	6G	6G	-	-
	15+20	-	-	3B	4A	6D	6D	-	-
	20+20	-	-	3B or 3 (Note 4)	4A or 4 (Note 4)	6A	6A	-	-
	3x20	-	-	_	-	6A	7	7	-
	15+20+20	-	-	-	-	6A	7A	7A	-
	10+20+20	-	-	-	-	6A	7B	7B	-
O 4	15+15+20					6D	7C	7C	-
CA	10+15+20	-	-	-	-	6D	7D	7D	-
with 3CCs	10+10+20	-	-	-	-	7E	7E	7E	-
3008	10+15+15	-	-	-	-	7F	7F	7F	-
	5+10+20	-	-	-	-	7G	7G	7G	-
	5+15+20	-	-	-	-	7H	7H	7H	-
	5+10+10	-	-	-	-	71	71	71	-
	4x20	-	-	-	-	-	7	8	8
CA	20+20+20+10	-	-	-	-	-	7	8A	8A
with	20+20+10+10	-	-	-	-	-	8B	8B	8B
4CCs	20+20+10+5	-	-	-	-	-	8C	8C	8C
	20+10+10+5	-	-	-	-	-	8D	8D	8D
CA with 5CCs	5x20	-	-	-	-	-	-	8	9

Note 1: Void.

Note 2: For non-CA UE, test is selected for maximum supported bandwidth.

Note 3: Void.

Note 4: If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, the single carrier test is selecte, i.e., Test 3 for UE category 3 and Test 4 for UE category 4. Otherwise, Test 3B applies for category 3 UE and Test 4A applies for category 4 UE.

Note 5: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Note 6: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

Table 8.7.1-5: test parameters for sustained downlink data rate (FDD 256QAM)

T 1	Bandwidth	Transmission	Antenna	Codebook	Downlink power allocation (dB)			$\hat{E}_{\scriptscriptstyle s}$ at	Symbols for
Test	(MHz)	mode	configuration	subset restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	antenna port (dBm/15kHz)	unused PRBs
1	20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
2	2x15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
2A	15+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3	10+15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
3A	20+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
4	10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
6	15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
7	2x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
8	3x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
9	15+20+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
10	10+20+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
11	15+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
12	10+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
13	10+10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
14	10+15+15	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
15	5+10+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
15A	5+15+20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
15B	5+10+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
16	4x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
17	20+20+20+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
18	20+20+10+10	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
18A	20+20+10+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
18B	20+10+10+5	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
19	5x20	3	2 x 2	10	-3	-3	0	-85	OP.1 FDD
Note 1	: For CA test of	ases, PUCCH forn	nat 3 is used to fe	edback ACK/I	NACK.			•	

Table 8.7.1-6: Minimum requirement (FDD 256QAM)

Test	Measurement channel	Reference value
		TB success rate [%]
1	R.68 FDD	85
2	R.68-1 FDD	85
24	R.68-1 FDD for 15MHz CC	85
2A	R.68-3 FDD for 5MHz CC	
2	R.68-2 FDD for 10MHz CC	85
3	R.68-1 FDD for 15MHz CC	
2.4	R.68 FDD for 20MHz CC	85
3A	R.68-3 FDD for 5MHz CC	
4	R.68-2 FDD for 10MHz CC	85
4	R.68 FDD for 20MHz CC	
	R.68-1 FDD for 15MHz CC	85
6	R.68 FDD for 20MHz CC	
7	R.68 FDD	85
8	R.68 FDD	85
	R.68-1 FDD for 15MHz CC	85
9	R.68 FDD for 20MHz CC	
4.0	R.68-2 FDD for 10MHz CC	85
10	R.68 FDD for 20MHz CC	
4.4	R.68-1 FDD for 15MHz CC	85
11	R.68 FDD for 20MHz CC	
	R.68-2 FDD for 10MHz CC	85
12	R.68-1 FDD for 15MHz CC	
	R.68 FDD for 20MHz CC	
4.0	R.68-2 FDD for 10MHz CC	85
13	R.68 FDD for 20MHz CC	
	R.68-2 FDD for 10MHz CC	85
14	R.68-1 FDD for 15MHz CC	
	R.68-3 FDD for 5MHz CC	85
15	R.68-2 FDD for 10MHz CC	
	R.68 FDD for 20MHz CC	
	R.68-3 FDD for 5MHz CC	85
15A	R.68-1 FDD for 15MHz CC	
	R.68 FDD for 20MHz CC	
450	R.68-3 FDD for 5MHz CC	85
15B	R.68-2 FDD for 10MHz CC	
16	R.68 FDD	85
47	R.68-2 FDD for 10MHz CC	85
17	R.68 FDD for 20MHz CC	
40	R.68-2 FDD for 10MHz CC	85
18	R.68 FDD for 20MHz CC	
	R.68-3 FDD for 5MHz CC	85
18A	R.68-2 FDD for 10MHz CC	
	R.68 FDD for 20MHz CC	
	R.68-3 FDD for 5MHz CC	85
18B	R.68-2 FDD for 10MHz CC	
	R.68 FDD for 20MHz CC	
19	R.68 FDD	85
Note 1:	For 2 layer transmissions, 2 transport b	locks are received within a
	TTI.	
Note 2:	The TB success rate is defined as TB s	uccess rate =

Note 2: The TB success rate is defined as TB success rate = 100%*N_{DL_correct_rx}/ (N_{DL_newtx} + N_{DL_retx}), where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport blocks, and N_{DL_correct_rx} is the number of correctly received DL transport blocks.

Table 8.7.1-7: Test points for sustained data rate (FRC 256QAM)

CA	Maximum supported Bandwidth/	Cat. 11, 12	DL Cat.	DL Cat.	DL Cat.	
config	Bandwidth combination (MHz)	DL Cat. 11, 12	13	15	16	
Single carrier	20	-	1	-	-	
	2x15	2	2	-	-	
	15+5	2A	2A	-	-	
CA	10+15	3	3	-	-	
with	20+5	3A	3A	-	-	
2CCs	10+20	4	4	-	-	
	15+20	6	6	-	-	
	20+20	7	7	-	-	
	3x20	8	7	8	-	
	15+20+20	9	7	9	-	
	10+20+20	10	7	10	-	
CA	15+15+20	11	6	11	-	
with	10+15+20	12	6	12	-	
3CCs	10+10+20	13	13	13	-	
3003	10+15+15	14	14	14	-	
	5+10+20	15	15	15	-	
	5+15+20	15A	15A	15A	-	
	5+10+10	15B	15B	15B	-	
	4x20	8	-	16	16	
CA	20+20+20+10	8	-	17	17	
with	20+20+10+10	18	-	18	18	
4CCs	20+20+10+5	18A	-	18A	18A	
	20+10+10+5	18B	-	18B	18B	
CA with 5CCs	5x20	-	-	16	19	

NOTE 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

8.7.2 TDD (single carrier and CA)

The parameters specified in Table 8.7.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.7.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value							
Special subframe configuration (Note 1)		4							
Cyclic prefix		Normal							
Cell ID		0							
Inter-TTI Distance		1							
Maximum number of HARQ transmission		4							
Redundancy version coding sequence		{0,0,1,2} for 64QAM and 256QAM							
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1							
Cross carrier scheduling		Not configured							
Propagation condition		Static propagation condition No external noise sources are applied							
Note 1: as specified in									

For UE not supporting 256QAM, the requirements are specified in Table 8.7.2-3, with the addition of the parameters in Table 8.7.2-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.2-4. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.2-6, with the addition of the parameters in Table 8.7.2-5 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.2-7. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirement in Table 8.7.2-3 is not applicable.

The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.2-2: test parameters for sustained downlink data rate (TDD 64QAM)

Test	Bandwidth	Transmission	Antenna	Codebook subset		Downlink power allocation (dB)		$\hat{E}_{\scriptscriptstyle s}$ at antenna	ACK/NACK	Symbols for unused
Test	(MHz)	mode	configuration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	port (dBm/15 kHz)	mode	PRBs
1	10	1	1 x 2	N/A	0	0	0	-85	Bundling	OP.6 TDD
2	10	3	2 x 2	10	-3	-3	0	-85	Bundling	OP.1 TDD
3	20	3	2 x 2	10	-3	-3	0	-85	Bundling	OP.1 TDD
3A	15	3	2 x 2	10	-3	-3	0	-85	Muliplexing	OP.2 TDD
4,6	20	3	2 x 2	10	-3	-3	0	-85	Multiplexing	OP.1 TDD
6A	2x20	3	2 x 2	10	-3	-3	0	-85	- (Note 1)	OP.1 TDD
6B	20+15	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD
7	3x20	3	2 x 2	10	-3	-3	0	-85	(Note 2)	OP.1 TDD
7A	15+20+20	3	2 x 2	10	-3	-3	0	-85	(Note 2)	OP.1 TDD
8	4x20	3	2 x 2	10	-3	-3	0	-85	(Note 2)	OP.1 TDD
9	15+3x20	3	2 x 2	10	-3	-3	0	-85	(Note 2)	OP.1 TDD

Note 1: PUCCH format 1b with channel selection is used to feedback ACK/NACK.

Note 2: PUCCH format 3 is used to feedback ACK/NACK.

Table 8.7.2-3: Minimum requirement (TDD 64QAM)

Test	Number of bits of a DL-SCH	Measurement channel	Reference value
	transport block received within		TB success rate [%]
	a TTI for normal/special sub-		
	frame		
1	10296/0	R.31-1 TDD	95
2	25456/0	R.31-2 TDD	95
3	51024/0	R.31-3 TDD	95
3A	51024/0	R.31-3A TDD	85
4	75376/0 (Note 2)	R.31-4 TDD	85
6	75376/0 (Note 2)	R.31-4 TDD	85
6A	75376/0 (Note 2)	R.31-4 TDD	85
6B	55056/0 for 15MHz CC	R.31-5 TDD for 15MHz CC	85
	75376/0 for 20MHz CC (Note 2)	R.31-4 TDD for 20MHz CC	
7	75376/0 (Note 2)	R.31-4 TDD	85
7.0	55056/0 for 15MHz CC	R.31-5 TDD for 15MHz CC	85
7A	75376/0 for 20MHz CC (Note 2)	R.31-4 TDD for 20MHz CC	85
8	75376/0 (Note 2)	R.31-4 TDD	85
9	55056/0 for 15MHz CC	R.31-5 TDD for 15MHz CC	85
9	75376/0 for 20MHz CC (Note 2)	R.31-4 TDD for 20MHz CC	

Note 2: 71112 bits for sub-frame 5.

Note 3: The TB success rate is defined as TB success rate = $100\%*N_{DL_correct_rx}/(N_{DL_newtx} + N_{DL_retx})$, where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport blocks, and $N_{DL_correct_rx}$ is the number of correctly received DL transport blocks.

Table 8.7.2-4: Test points for sustained data rate (FRC 64QAM)

CA config	Bandwidth/ Bandwidth combination (MHz)	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 6,7	Cat. 9, 10	Cat. 11, 12 DL Cat. 11, 12	DL Cat. 15
Cinalo	10	1	2	-	-	1	-	-	ı
Single	15	-	-	3A	3A	-	-	-	-
carrier	20	-	-	3	4	6	-	-	-
CA with	20+20	-		3(Note 4)	4 (Note 4)	6A	6A	-	-
2CCs	15+20	-	-	3(Note 4)	4 (Note 4)	6B	6B	-	-
CA with 3	3x20	-	-	-	-	6A	7	7	-
CCs	15+20+20	-	-	-	-	6A	7A	7A	-
CA with 4	4x20	-	-	-	-	-	7	8	8
CCs	15+3x20	-	-	-	-	-	7	9	9

Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category.

Otherwise, select the test point according to the UE category signalled.

Note 2: For non-CA UE, test is selected for maximum supported bandwidth.

Note 3: Void.

Note 4: If the intra-band contiguous CA is the only CA configuration supported by category 3 or 4 UE, single carrier test is selected.

Note 5: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 8.1.2.3.

Table 8.7.2-5: test parameters for sustained downlink data rate (TDD 256QAM)

Test	Bandwidth	Transmission	Antenna	Codebook subset		Downlink power allocation (dB)		power		power		power		power and coation (dB)		$\hat{E}_{\scriptscriptstyle s}$ at antenna	ACK/NACK feedback	Symbols for unused
1030	(MHz)	mode	configuration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	ь	port (dBm/15 kHz)	mode	PRBs								
1	20	3	2 x 2	10	-3	-3	0	-85	Bundling	OP.1 TDD								
2	15+20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD								
3	2x20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD								
4	3x20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD								
5	15+20+20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD								
6	4x20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD								
7	15+3x20	3	2 x 2	10	-3	-3	0	-85	(Note 1)	OP.1 TDD								
Note 1	1: For CA to	est cases, PUCCI	I format 3 is used	to feedback	ACK/N	ACK.												

Table 8.7.2-6: Minimum requirement (TDD 256QAM)

Test		Measurement channel	Reference value						
			TB success rate [%]						
1		R.68 TDD	85						
2		R.68-1 TDD for 15MHz CC	85						
2		R.68 TDD for 20MHz CC							
3		R.68 TDD	85						
4 R.68 TDD		R.68 TDD	85						
5		R.68-1 TDD for 15MHz CC	85						
3		R.68 TDD for 20MHz CC							
6	6 R.68 TDD		85						
7		R.68-1 TDD for 15MHz CC	85						
-		R.68 TDD for 20MHz CC							
Note 1:	F	or 2 layer transmissions, 2 transp	ort blocks are received						
	W	ithin a TTI.							
Note 2:	T	he TB success rate is defined as	TB success rate =						
	10	00% * $N_{DL_correct_rx}/(N_{DL_newtx} + N_{DL})$	$_{\rm retx}$), where $N_{\rm DL_newtx}$ is the						
number of newly transmitted DL transport blocks, N _{DL_retx} is									
	the number of retransmitted DL transport blocks, and								
	Ν	DL_correct_rx is the number of correct	tly received DL transport						
	bl	ocks.							

Table 8.7.2-7: Test points for sustained data rate (FRC 256QAM)

CA config	Bandwidth/ Bandwidth combination (MHz)	Cat. 11, 12 DL Cat. 11, 12	DL Cat. 13	DL Cat. 15	DL Cat. 16	
Single carrier	20	-	1	-	-	
CA with	15+20	2	2	-		
2CCs	2x20	3	3	-	1	
CA with 3	3x20	4	3	4	ı	
CCs	15+20+20	5	3	5	ı	
CA with 4	4x20	4	ı	6	6	
CCs	15+3x20	5	ı	7	7	

8.7.3 FDD (EPDCCH scheduling)

The parameters specified in Table 8.7.3-1 are valid for all FDD tests unless otherwise stated.

Table 8.7.3-1: Common test parameters (FDD)

Parameter	Unit	Value					
Cyclic prefix		Normal					
Cell ID		0					
Inter-TTI Distance		1					
Number of HARQ							
processes per	Processes	8					
component carrier							
Maximum number of		4					
HARQ transmission		4					
Redundancy version		(0.0.4.0) for 0.40 AM					
coding sequence		{0,0,1,2} for 64QAM					
Number of OFDM							
symbols for PDCCH per	OFDM symbols	1					
component carrier	•						
Cross carrier scheduling		Not configured					
Number of EPDCCH		1					
sets		l l					
EPDCCH transmission		Localized					
type		Localized					
Number of PRB per		2 PRB pairs					
EPDCCH set and		10MHz BW: Resource blocks n _{PRB} = 48, 49					
EPDCCH PRB pair		15MHz BW: Resource blocks n _{PRB} = 70, 71					
allocation		20MHz BW: Resource blocks n _{PRB} = 98, 99					
EPDCCH Starting		Derived from CFI (i.e. default behaviour)					
Symbol		Derived from CF1 (i.e. default benaviour)					
ECCE Aggregation		2 ECCEs					
Level		2 ECCES					
Number of EREGs per		4					
ECCE		·					
EPDCCH scheduling		EPDCCH candidate is randomly assigned					
EPDCCH scheduling		in each subframe					
EPDCCH precoder		Fixed PMI 0					
(Note 1)		FIXEU PIVII U					
EPDCCH monitoring SF		1111111111 0000000000					
pattern		1111111111 0000000000					
Timing advance	μs	100					
Propagation condition		Static propagation condition					
Propagation condition		No external noise sources are applied					
Note 1: EPDCCH preco	oder parameters are	defined for tests with 2 x 2 antenna					
configuration							

The requirements are specified in Table 8.7.3-3, with the addition of the parameters in Table 8.7.3-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.3-4. The TB success rate shall be sustained during at least 300 frames.

Table 8.7.3-2: Test parameters for SDR test for PDSCH scheduled by EPDCCH (FDD)

Test	Bandwidth	Transmission	Antenna	Codebook subset		ownlin			$\hat{E}_{\scriptscriptstyle S}$ at	Symbols for
Test	(MHz)	mode	configuration	restriction	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	δ	antenna port (dBm/15kHz)	unused PRBs
1	10	1	1 x 2	N/A	0	0	0	0	-85	OP.6 FDD
2	10	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD
3,4,6	20	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD
ЗА	10	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD
3C, 4B	15	3	2 x 2	10	-3	-3	0	3	-85	OP.1 FDD

Table 8.7.3-3: Minimum requirement (FDD)

Test	Number of bits of a DL-SCH transport	Measurement channel	Reference value
	block received within a TTI		TB success rate [%]
1	10296	R.31E-1 FDD	95
2	25456	R.31E-2 FDD	95
3	51024	R.31E-3 FDD	95
3A	36696 (Note 2)	R.31E-3A FDD	85
3C	51024	R.31E-3C FDD	85
4	75376 (Note 3)	R.31E-4 FDD	85
4B	55056 (Note 5)	R.31E-4B FDD	85
6	75376 (Note 3)	R.31E-4 FDD	85

Note 2: 35160 bits for sub-frame 5. Note 3: 71112 bits for sub-frame 5.

Note 4: The TB success rate is defined as TB success rate = 100%*N_{DL_correct_rx/} (N_{DL_newtx} + N_{DL_retx}), where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport

blocks, and N_{DL_correct_rx} is the number of correctly received DL transport blocks.

Note 5: 52752 bits for sub-frame 5.

Table 8.7.3-4: Test points for sustained data rate (FRC)

CA config	Bandwidth (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7
Cinalo	10	1	2	3A	3A	-	-
Single	15	-	-	3C	4B	-	-
carrier	20	-	-	3	4	6	6
Note 1: 7	he test is selected for	maximum sur	ported bandw	vidth.			

8.7.4 TDD (EPDCCH scheduling)

The parameters specified in Table 8.7.4-1 are valid for all TDD tests unless otherwise stated.

Table 8.7.4-1: Common test parameters (TDD)

Parameter	Unit	Value
Special subframe		4
configuration (Note 1)		·
Cyclic prefix		Normal
Cell ID		0
Inter-TTI Distance		1
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,0,1,2} for 64QAM
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	1
Cross carrier scheduling		Not configured
Number of EPDCCH sets		1
EPDCCH transmission type		Localized
Number of PRB per EPDCCH set and EPDCCH PRB pair allocation		2 PRB pairs 10MHz BW: Resource blocks n _{PRB} = 48, 49 15MHz BW: Resource blocks n _{PRB} = 70, 71 20MHz BW: Resource blocks n _{PRB} = 98,
EPDCCH Starting Symbol		99 Derived from CFI (i.e. default behaviour)
ECCE Aggregation Level		2 ECCEs
Number of EREGs per ECCE		4 for normal subframe and for special subframe
EPDCCH scheduling		EPDCCH candidate is randomly assigned in each subframe
EPDCCH precoder (Note 2)		Fixed PMI 0
EPDCCH monitoring SF pattern		UL-DL configuration 1: 1101111111 000000000 UL-DL configuration 5: 1100111001 000000000
Timing advance	μs	100
Propagation condition		Static propagation condition No external noise sources are applied
Note 1: As specified in Note 2: EPDCCH preconfiguration	Table 4.2-1 in TS 36 oder parameters are	.211 [4]. defined for tests with 2 x 2 antenna

The requirements are specified in Table 8.7.4-3, with the addition of the parameters in Table 8.7.4-2 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category, CA capability and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.4-4. The TB success rate shall be sustained during at least 300 frames.

Table 8.7.4-2: Test parameters for SDR test for PDSCH scheduled by EPDCCH (TDD)

Test	Bandwidth (MHz)	Transmission mode	Antenna configuration	Codebook subset	Downlink power allocation (dB)				$\hat{E}_{\scriptscriptstyle s}$ at antenna port	Symbols for unused	ACK/NACK feedback
	(iii) ρ_A	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ	δ	(dBm/15kHz)	PRBs	mode			
1	10	1	1 x 2	N/A	0	0	0	0	-85	OP.6 TDD	Bundling
2	10	3	2 x 2	10	-3	-3	0	3	-85	OP.1 TDD	Bundling
3	20	3	2 x 2	10	-3	-3	0	3	-85	OP.1 TDD	Bundling
ЗА	15	3	2 x 2	10	-3	-3	0	3	-85	OP.2 TDD	Multiplexing
4,6	20	3	2 x 2	10	-3	-3	0	3	-85	OP.1 TDD	Multiplexing

Table 8.7.4-3: Minimum requirement (TDD)

Test	Number of bits of a DL-SCH transport block received within a TTI for normal/special sub-frame	Measurement channel	Reference value TB success rate [%]		
1	10296/0	R.31E-1 TDD	95		
2	25456/0	R.31E-2 TDD	95		
3	51024/0	R.31E-3 TDD	95		
3A	51024/0	R.31E-3A TDD	85		
4	75376/0 (Note 2)	R.31E-4 TDD	85		
6	75376/0 (Note 2)	R.31E-4 TDD	85		

Note 2: 71112 bits for sub-frame 5.

Note 3: The TB success rate is defined as TB success rate = $100\%*N_{DL_correct_rx}/(N_{DL_newtx} + N_{DL_retx})$, where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport blocks, and $N_{DL_correct_rx}$ is the number of correctly received DL transport blocks.

Table 8.7.4-4: Test points for sustained data rate (FRC)

CA config	Bandwidth/ Bandwidth combination (MHz)	Category 1	Category 2	Category 3	Category 4	Category 6	Category 7		
Cinalo	10	1	2	-	-	-	-		
Single	15	-	-	3A	3A	-	-		
carrier	20	-	-	3	4	6	6		
Note 1: T	Note 1: The test is selected for maximum supported bandwidth.								

8.7.5 TDD FDD CA

The parameters specified in Table 8.7.5-1 are valid for all TDD FDD CA tests unless otherwise stated.

Table 8.7.5-1: Common Test Parameters (TDD FDD CA)

Parameter		Unit	Value
Uplink downlink configuration TDD CC			1
Special subframe configuration for TDD CC	ation (Note 2)		4
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
	σ	dB	0
Cyclic prefix			Normal
Cell ID			0
Inter-TTI Distan	ce		1
Maximum number of HARQ processes per	FDD PCell	Processes	8 for FDD and TDD CCs
component carrier	TDD PCell	Processes	11 for FDD CC; 7 for TDD CC
Maximum number of HARO	transmission		4
Redundancy version codi	ng sequence		{0,0,1,2} for 64QAM, 256QAM
Number of OFDM symbol per component ca		OFDM symbols	1
Cross carrier schee	duling		Not configured
Propagation cond	lition		Static propagation condition No external noise sources are applied
Transmission mo	ode		TM3
Codebook subset res	striction		10
Antenna configura	ation		2 x 2
$\hat{E}_{\scriptscriptstyle s}$ at antenna port (dB	m/15kHz)		-85
Symbols for unused	PRBs		OP.1 FDD for FDD CC, OP.1 TDD for TDD CC
ACK/NACK feedbac	k mode		PUCCH format 3
Downlink HARQ-ACK	FDD PCell		As specified in Clause 7.3.3 in TS36.213 [6]
timing	TDD PCell		As specified in Clause 7.3.4 in TS36.213 [6]

8.7.5.1 Minimum Requirement FDD PCell

For UE not supporting 256QAM, the requirements for TDD FDD CA with FDD PCell are specified in Table 8.7.5.1-1 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.5.1-2. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements for TDD FDD CA with FDD PCell are specified in Table 8.7.5.1-3 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category or UE DL category, and bandwidth combination with the maximum aggregated bandwidth as specified in Table 8.7.5.1-4. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirement in Table 8.7.5.1-1 is not applicable.

The applicability of the requirements are specified in Clause 8.1.2.3B. The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.5.1-1: test parameters for sustained downlink data rate (TDD FDD CA 64QAM)

Test num ber	Ban	dwidth (MH	z)	SCH trans received w	al/special for TDD,	Measureme	nt channel	Reference value
	Total	FDD CC	TDD CC	FDD CC	TDD CC	FDD CC	TDD CC	TB success rate [%]
1	2x20	20	20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
2	10+20	10	20	36696	75376/0	R.31-3A FDD	R.31-4 TDD	85
2A	15+20	15	20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
3	10+10	10	10	36696	36696/0	R.31-3A FDD	R.31-6 TDD	85
4	3x20	20	2x20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
5	15+20+20	15	2x20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
6	10+20+20	10	2x20	36696	75376/0	R.31-3A FDD	R.31-4 TDD	85
7	3x20	2x20	20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
8	20+20+15	20+15	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC R.31-4 FDD for	R.31-4 TDD	85
9	20+20+10	20+10	20	75376 for 20MHz CC 36696 for 10MHz CC	75376/0	20MHz CC, R.31-3A FDD for 10MHz CC	R.31-4 TDD	85
9A	20+10+10	2x10	20	36696	75376/0	R.31-3A	R.31-4 TDD	85
10	4x20	20	3x20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
11	4x20	2×20	2×20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
12	3x20+15	20+15	2×20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
13	2×15+2×20	2×15	2x20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
14	3x20+15	2×20+15	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
15	2×15+2x20	2x15+20	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
15A	3x20+10	2x20+10	20	75376 for 20MHz CC 36696 for 10MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-3A FDD for 10MHz CC	R.31-4 TDD	85
15B	2x15+2x20	2x15+20	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
16	4x20+15	2x20+15	2x20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
17	2x15+3x20	2x15+20	2x20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85

Table 8.7.5.1-2: Test points for sustained data rate (FRC 64QAM)

CA	Maximum su Bandwidth	ipported Ba		Cat. 1 (Cat. 2	Cat. 3	Cat. 4	Cat. 6,	Cat. 9,10	Cat 11, 12	DL Cat.
config	Total	FDD CC	TDD CC	Cat. 1	Cat. 2	Cat. 3	Cat. 4	DL Cat. 6, 7	DL Cat. 9, 10	DL Cat.	15
	2420	20	20			2	2	0, /	9, 10	11, 12	
CA	2x20	20	20	-	-	3	3	1	'	-	-
with	10+20	10	20	-	-	3	3	2	2	-	-
2CCs	15+20	15	20	-	-	3	3	2A	2A	-	-
	10+10	10	10	ı	-	3	3	3	3	-	-
	3x20	20	2x20	-	-	-	-	1	4	4	-
	15+20+20	15	2x20	ı	-	-	-	2A	5	5	-
CA with	10+20+20	10	2x20	-	-	-	-	2	6	6	-
	3x20	2x20	20	-	-	-	-	1	7	7	-
3CCs	20+20+15	20+15	20	-	-	-	-	1	8	8	-
	20+20+10	20+10	20	-	-	-	-	1	9	9	-
	20+10+10	2x10	20	-	-	-	-	2	9A	9A	-
	4x20	20	3x20	-	-	-	-	-	4	10	10
	4x20	2×20	2×20	ı	-	-	•	-	4 or 7	11	11
C 4	3x20+15	20+15	2×20	-	-	-	-	-	4	12	12
CA with	2×15+2x20	2×15	2x20	-	-	-	-	-	5	13	13
4CCs	3x20+15	2×20+15	20	-	-	-	-	-	7	14	14
4005	2×15+2x20	2x15+20	20	-	-	-	-	-	8	15	15
	3x20+10	2x20+10	20	-	-	-	-	-	7	15A	15A
	2x15+2x20	2x15+20	20	-	-	-	-	-	8	15B	15B
CA	4x20+15	2x20+15	2x20	-	-	-	-	-	-	11	16
with 5 CCs	2x15+3x20	2x15+20	2x20	-	-	-	-	-	-	12	17

Note 1: Void. Note 2: Void.

Note 3: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

Table 8.7.5.1-3: Minimum requirement (TDD FDD CA 256QAM)

Test	Bar	ndwidth (MF	lz)	Measurem	ent channel	Reference value
number	Total	FDD CC	TDD CC	FDD CC	TDD CC	TB success rate [%]
1	2x20	20	20	R.68 FDD	R.68 TDD	85
2	10+20	10	20	R.68-2 FDD	R.68 TDD	85
3	15+20	15	20	R.68-1 FDD	R.68 TDD	85
4	3x20	20	2x20	R.68 FDD	R.68 TDD	85
5	15+20+20	15	2x20	R.68-1 FDD	R.68 TDD	85
6	10+20+20	10	2x20	R.68-2 FDD	R.68TDD	85
7	3x20	2x20	20	R.68 FDD	R.68 TDD	85
8	20+20+15	20+15	20	R.68 FDD for 20MHz CC, R.68-1 FDD fo 15MHz CC	B 68 TDD	85
9	20+20+10	20+10	20	R.68 FDD for 20MHz CC, R.68-2 FDD fo 10MHz CC	R 68 TDD	85
9A	20+10+10	2x10	20	R.68-2 FDD	R.68 TDD	85
10	4x20	20	3x20	R.68-2 FDD	R.68TDD	85
11	4x20	2×20	2×20	R.68 FDD	R.68 TDD	85
12	3x20+15	20+15	2×20	R.68 FDD for 20MHz CC, R.68-1 FDD fo 15MHz CC	D 68 TDD	85
13	2x15+2x2 0	2×15	2x20	R.68-1 FDD	R.68 TDD	85
14	3x20+15	2×20+15	20	R.68 FDD for 20MHz CC, R.68-1 FDD fo 15MHz CC	R 68 TDD	85
15	2×15+2×2 0	2x15+20	20	R.68 FDD for 20MHz CC, R.68-1 FDD fo 15MHz CC	R 68 TDD	85
15A	3x20+10	2x20+10	20	R.68 FDD for 20MHz CC, R.68-2 FDD fo 10MHz CC	B 68 TDD	85
15B	2x15+2x20	2x15+20	20	R.68 FDD for 20MHz CC, R.68-1 FDD fo 15MHz CC	B 68 TDD	85
16	4x20+15	2x20+15	2x20	R.68 FDD for 20MHz CC, R.68-1 FDD fo 15MHz CC	D 68 TDD	85
17	2x15+3x20	2x15+20	2x20	R.68 FDD for 20MHz CC, R.68-1 FDD fo 15MHz CC	B 88 TDD	85

Table 8.7.5.1-4: Test points for sustained data rate (FRC 256QAM)

CA	Maximum su Bandwidth	ipported Ba combinatio		Cat. 11, 12	DL Cat.	DL Cat.	DL Cat.		
config	Total	FDD CC	TDD CC	DL Cat. 11, 12	13	15	16		
CA	2x20	20	20	1	1	-	-		
with	10+20	10	20	2	2				
2CCs	15+20	15	20	3	3	-	-		
	3x20	20	2x20	4	1	4	-		
	15+20+20	15	2x20	5	3	5	-		
CA	10+20+20	10	2x20	6	2	6	-		
with	3x20	2x20	20	7	1	7	-		
3CCs	20+20+15	20+15	20	8	1	8	-		
	20+20+10	20+10	20	9	1	9	-		
	20+10+10	2x10	20	9A	2	9A			
	4x20	20	3x20	4	-	10	10		
	4x20	2×20	2×20	4 or 7	-	11	11		
[3x20+15	20+15	2×20	8	-	12	12		
CA with	2×15+2x20	2×15	2x20	5	-	13	13		
4CCs	3x20+15	2×20+15	20	7	-	14	14		
4005	2×15+2x20	2x15+20	20	8	-	15	15		
	3x20+10	2x20+10	20	7	-	15A	15A		
	2x15+2x20	2x15+20	20	8		15B	15B		
CA	4x20+15	2x20+15	2x20	-	-	14 or 12	16		
with 5CCs	2x15+3x20	2x15+20	2x20	-	-	15 or 12	17		
Note 1:	If DL category	is signalled	by the UF u	nder test, the	en select the	test point ac	cording to U	JF DL Catego	orv

Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category.

Otherwise, select the test point according to the UE category signalled.

8.7.5.2 Minimum Requirement TDD PCell

For UE not supporting 256QAM, the requirements for TDD FDD CA with TDD PCell are specified in Table 8.7.5.2-1 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.5.2-2. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements for TDD FDD CA with FDD PCell are specified in Table 8.7.5.2-3 with the additional parameters specified in Table 8.7.5-1, and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category or UE DL category, and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.5.2-4. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.5.2-1 is not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3B. The test coverage for different number of component carriers is defined in 8.1.2.4.

Table 8.7.5.2-1: test parameters for sustained downlink data rate (TDD FDD CA 64QAM)

Test num ber	Bar	ndwidth (MH	lz)	Number of bits of a DL- SCH transport block received within a TTI (for normal/special subframe for TDD, except for subframe #5)		Measureme	nt channel	Referenc e value
	Total	FDD CC	TDD CC	FDD CC	TDD CC	FDD CC	TDD CC	TB success rate [%]
1	2x20	20	20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
2	10+20	10	20	36696	75376/0	R.31-3A FDD	R.31-4 TDD	85
2A	15+20	15	20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
3	10+10	10	10	36696	36696/0	R.31-3A FDD	R.31-6 TDD	85
4	3x20	20	2x20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
5	15+20+20	15	2x20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
6	10+20+20	10	2x20	36696	75376/0	R.31-3A FDD	R.31-4 TDD	85
7	3x20	2x20	20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
8	20+20+15	20+15	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
9	20+20+10	20+10	20	75376 for 20MHz CC 36696 for 10MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-3A FDD for 10MHz CC	R.31-4 TDD	85
9A	20+10+10	2x10	20	36696	75376/0	R.31-3A	R.31-4 TDD	85
10	4x20	20	3x20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
11	4x20	2×20	2×20	75376	75376/0	R.31-4 FDD	R.31-4 TDD	85
12	3x20+15	20+15	2×20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
13	2×15+2×20	2×15	2x20	55056	75376/0	R.31-5 FDD	R.31-4 TDD	85
14	3x20+15	2×20+15	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
15	2×15+2×20	2x15+20	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
15A	3x20+10	2x20+10	20	75376 for 20MHz CC 36696 for 10MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-3A FDD for 10MHz CC	R.31-4 TDD	85
15B	2x15+2x20	2x15+20	20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
16	4x20+15	2x20+15	2x20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85
17	2x15+3x20	2x15+20	2x20	75376 for 20MHz CC 55056 for 15MHz CC	75376/0	R.31-4 FDD for 20MHz CC, R.31-5 FDD for 15MHz CC	R.31-4 TDD	85

Table 8.7.5.2-2: Test points for sustained data rate (FRC 64QAM)

CA	Maximum su Bandwidth	ipported Ba		Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 6,	Cat. 9,10	Cat 11, 12	DL Cat.
config	Total	FDD CC	TDD CC	Cat. 1	Cat. 2	Cat. 3	Cat. 4	DL Cat. 6, 7	DL Cat. 9, 10	DL Cat.	15
	2420	20	20			2	2	0, /	9, 10	11, 12	
CA	2x20	20	20	-	-	3	3	1	'	-	-
with	10+20	10	20	-	-	3	3	2	2	-	-
2CCs	15+20	15	20	-	-	3	3	2A	2A	-	-
	10+10	10	10	ı	-	3	3	3	3	-	-
	3x20	20	2x20	-	-	-	-	1	4	4	-
	15+20+20	15	2x20	ı	-	-	-	2A	5	5	-
CA	10+20+20	10	2x20	-	-	-	-	2	6	6	-
with	3x20	2x20	20	-	-	-	-	1	7	7	-
3CCs	20+20+15	20+15	20	-	-	-	-	1	8	8	-
	20+20+10	20+10	20	-	-	-	-	1	9	9	-
	20+10+10	2x10	20	-	-	-	-	2	9A	9A	-
	4x20	20	3x20	-	-	-	-	-	4	10	10
	4x20	2×20	2×20	ı	-	-	•	-	4 or 7	11	11
C 4	3x20+15	20+15	2×20	-	-	-	-	-	4	12	12
CA with	2×15+2x20	2×15	2x20	-	-	-	-	-	5	13	13
4CCs	3x20+15	2×20+15	20	-	-	-	-	-	7	14	14
4005	2×15+2x20	2x15+20	20	-	-	-	-	-	8	15	15
	3x20+10	2x20+10	20	-	-	-	-	-	7	15A	15A
	2x15+2x20	2x15+20	20	-	-	-	-	-	8	15B	15B
CA	4x20+15	2x20+15	2x20	-	-	-	-	-	-	11	16
with 5 CCs	2x15+3x20	2x15+20	2x20	-	-	-	-	-	-	12	17

Note 1: Void. Note 2: Void.

Note 3: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

Table 8.7.5.2-3: Minimum requirement (TDD FDD CA 256QAM)

Test	Ban	dwidth (MH	z)	Measureme	ent channel	Reference value
number	Total	FDD CC	TDD CC	FDD CC	TDD CC	TB success rate [%]
1	2x20	20	20	R.68 FDD	R.68 TDD	85
2	10+20	10	20	R.68-2 FDD	R.68 TDD	85
3	15+20	15	20	R.68-1 FDD	R.68 TDD	85
4	3x20	20	2x20	R.68 FDD	R.68 TDD	85
5	15+20+20	15	2x20	R.68-1 FDD	R.68 TDD	85
6	10+20+20	10	2x20	R.68-2 FDD	R.68TDD	85
7	3x20	2x20	20	R.68 FDD	R.68 TDD	85
8	20+20+15	20+15	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
9	20+20+10	20+10	20	R.68 FDD for 20MHz CC, R.68-2 FDD for 10MHz CC	R.68 TDD	85
9A	20+10+10	2x10	20	R.68-2 FDD	R.68 TDD	85
10	4x20	20	3x20	R.68-2 FDD	R.68TDD	85
11	4x20	2×20	2×20	R.68 FDD	R.68 TDD	85
12	3x20+15	20+15	2×20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
13	2×15+2x20	2×15	2x20	R.68-1 FDD	R.68 TDD	85
14	3x20+15	2×20+15	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
15	2×15+2x20	2x15+20	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
15A	3x20+10	2x20+10	20	R.68 FDD for 20MHz CC, R.68-2 FDD for 10MHz CC	R.68 TDD	85
15B	2x15+2x20	2x15+20	20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
16	4x20+15	2x20+15	2x20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85
17	2x15+3x20	2x15+20	2x20	R.68 FDD for 20MHz CC, R.68-1 FDD for 15MHz CC	R.68 TDD	85

Table 8.7.5.2-4: Test points for sustained data rate (FRC 256QAM)

CA	Maximum sı Bandwidth	upported Ba combinatio		Cat. 11, 12	DL Cat.	DL Cat.	DL Cat.	
config	Total	FDD CC	TDD CC	DL Cat. 11, 12	13	15	16	
CA	2x20	20	20	1	1	-	-	
with	10+20	10	20	2	2			
2CCs	15+20	15	20	3	3	-	-	
	3x20	20	2x20	4	1	4	-	
	15+20+20	15	2x20	5	3	5	ı	
CA	10+20+20	10	2x20	6	2	6	ı	
with	3x20	2x20	20	7	1	7	ı	
3CCs	20+20+15	20+15	20	8	1	8	-	
	20+20+10	20+10	20	9	1	9	-	
	20+10+10	2x10	20	9A	2	9A		
	4x20	20	3x20	4	-	10	10	
	4x20	2×20	2×20	4 or 7	-	11	11	
[3x20+15	20+15	2×20	8	-	12	12	
CA with	2×15+2x20	2×15	2x20	5	-	13	13	
4CCs	3x20+15	2×20+15	20	7	-	14	14	
4005	2×15+2x20	2x15+20	20	8	-	15	15	
	3x20+10	2x20+10	20	7	-	15A	15A	
	2x15+2x20	2x15+20	20	8	-	15B	15B	
CA	4x20+15	2x20+15	2x20	-	-	14 or 12	16	
with 5CCs	2x15+3x20	2x15+20	2x20	-	-	15 or 12	17	

Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

8.7.6 FDD (DC)

The parameters specified in Table 8.7.6-1 are valid for all FDD DC tests unless otherwise stated.

Table 8.7.6-1: Common Test Parameters (FDD)

Parai	neter	Unit	Value
Cyclic	prefix		Normal
Cel	IID		0
Inter-TTI	Distance		1
compone	Q processes per ent carrier	Processes	8
	nber of HARQ nission		4
Redundancy version	n coding sequence		{0,0,1,2} for 64QAM and 256QAM
	symbols for PDCCH nent carrier	OFDM symbols	1
Cross carrie	r scheduling		Not configured
Propagatio	n condition		Static propagation condition No external noise sources are applied
Transmission mode			TM3
Codebook sub	set restriction		10
Antenna co	onfiguration		2x2
$\hat{E}_{\scriptscriptstyle s}$ at antenna p	ort (dBm/15kHz)		-85
Symbols for t	unused PRBs		OP.1 FDD
ACK/NACK fe	edback mode		Separate ACK/NACK feedbacks with PUCCH format 3 on the MCG and SCG
Time offset between MCG CC and SCG CC		μs	O for UE under test supporting synchronous dual connectivity; 500 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 1)
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB dB	-3
	σ		0 ity are defined in TS36.300 [11].

If the UE supports both SCG bearer and Split bearer, the Split bearer is configured.

For UE not supporting 256QAM, the requirements are specified in Table 8.7.6-2, with the addition of the parameters in Table 8.7.6-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.6-3. The TB success rate across CGs shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.6-4, with the addition of the parameters in Table 8.7.6-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.6-5. The TB success rate across CGs shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.6-2 are not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3A.

Table 8.7.6-2: Minimum requirement (DC 64QAM)

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Test number	Bandwidth combination (MHz)	Number of bits of a DL-SCH transport block received	Measurement channel		rence value ccess rate(%	b)
		within a TTI		DRB type of Split bearer		e of SCG (Note 3)
				(Note 2)	MCG	SCG
1	2x10	25456	R.31-2 FDD	95	95	95
2	2x10	36696 (Note 4)	R.31-3A FDD	85	85	85
3	10+20	36696 (Note 4) for 10MHz CC 75376 (Note 5) for 20MHz CC	R.31-3A FDD for 10MHz CC R.31-4 FDD for 20MHz CC	85	85	85
4	2x15	55056 (Note 6)	R.31-4B FDD	85	85	85
5	15+20	55056 for 15MHz CC 75376 (Note 5) for 20MHz CC	R.31-5 FDD for 15MHz CC R.31-4 FDD for 20MHz CC	85	85	85
6	2x20	75376 (Note 5)	R.31-4 FDD	85	85	85
6A	10+15	36696 (Note 4) for 10MHz CC 55056 (Note 6) for 15MHz CC	R.31-2 FDD for 10MHz CC R.31-5 FDD for 15MHz CC	85	85	85
7	15+5	55056 for 15MHz CC 18336 for 5MHz CC	R.31-5 FDD for 15MHz CC R.31-6 FDD for 5MHz CC	85	85	85
8	15+20+20	55056 for 15MHz CC 75376 (Note 5) for 20MHz CC	R.31-5 FDD for 15MHz CC R.31-4 FDD for 20MHz CC	85	85	85
9	15+15+20	55056for 15MHz CC 75376 (Note 5) for 20MHz CC	R.31-5 FDD for 15MHz CC R.31-4 FDD for 20MHz CC	85	85	85
10	10+10+20	36696 (Note 4) for 10MHz CC 75376 (Note 5) for 20MHz CC	R.31-2 FDD for 10MHz CC R.31-4 FDD for 20MHz CC	85	85	85
11	10+15+15	36696 (Note 4) for 10MHz CC 55056 (Note 6) for 15MHz CC	R.31-2 FDD for 10MHz CC R.31-5 FDD for 15MHz CC	85	85	85
12	10+15+20	36696 (Note 4) for 10MHz CC 55056 (Note 6) for 15MHz CC 75376 (Note 5) for 20MHz CC	R.31-2 FDD for 10MHz CC R.31-5 FDD for 15MHz CC R.31-4 FDD for 20MHz CC	85	85	85
13	10+20+20	36696 (Note 4) for 10MHz CC 75376 (Note 5) for 20MHz CC	R.31-2 FDD for 10MHz CC R.31-4 FDD for 20MHz CC	85	85	85
14	3x20	75376 (Note 5)	R.31-4 FDD	85	85	85

Note 1: For 2 layer transmissions, 2 transport blocks are received within a TTI.

Note 2: For the configuration of DRB type of Split bearer, the TB success rate across CGs is defined as TB success rate = 100%*NDL_correct_rx/ (NDL_newtx + NDL_retx), where NDL_newtx is the number of newly transmitted DL transport blocks , NDL_retx is the number of retransmitted DL transport blocks, and NDL_correct_rx is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.

Note 3: For the configuration of DRB type of SCG bearer, the TB success rate across CGs is defined as TB success rate = 100%*Npl_correct_rx/ (Npl_newtx + Npl_retx), where Npl_newtx is the number of newly transmitted DL transport blocks, Npl_retx is the number of retransmitted DL transport blocks, and Npl_correct_rx is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blocks per CG used for DC

transmission or reception, separately. 35160 bits for sub-frame 5.

Note 4: 35160 bits for sub-frame 5. Note 5: 71112 bits for sub-frame 5. Note 6: 52752 bits for sub-frame 5.

Table 8.7.6-3: Test points for sustained data rate (FRC DC 64QAM)

DC	DC supported Cat. 3 Cat. 4 Cat. 6, combination (MHz)		Cat 6 7	Cat. 9, 10	Cat. 11, 12		
config			Cat. 4	Sat. 4 Sat. 6, 7		DL Cat. 11,12	
	2x10	1	2	2	2	-	
	10+20	1	2	3	3	-	
DC with	2x15	1	2	4	4	-	
2CCs	15+20	1	2	5	5	-	
2008	2x20	1	2	6	6	-	
	10+15	1	2	6A	6A	-	
	15+5	7	7	7	7	-	
	15+20+20	-	-	8	8	8	
	15+15+20	-	-	9	9	9	
DC with	10+10+20	-	-	10	10	10	
DC with 3 CCs	10+15+15	-	-	11	11	11	
3 008	10+15+20	-	-	12	12	12	
	10+20+20	-	-	13	13	13	
	20+20+20	-	-	14	14	14	

Table 8.7.6-4: Minimum requirement (DC 256QAM)

Test number	Bandwidth combination (MHz)	Measurement channel		erence value ccess rate (%	6)
			DRB type of Split bearer (Note 2)		e of SCG (Note 3) SCG
1	2x10	R.68-2 FDD	85	85	85
2	10+20	R.68-2 FDD for	85	85	85
	10120	10MHz CC R.68 FDD for 20MHz CC	55		
3	2x15	R.68-1 FDD	85	85	85
4	15+20	R.68-1 FDD for 15MHz CC R.68 FDD for 20MHz CC	85	85	85
5	2x20	R.68 FDD	85	85	85
6	15+5	R.68-1 FDD for 15MHz CC R.68-3 FDD for 5MHz CC	85	85	85
6A	10+15	R.68-2 FDD for 10MHz CC R.68-1 FDD for 15MHz CC	85	85	85
7	15+20+20	R.68-1 FDD for 15MHz CC R.68 FDD for 20MHz CC	85	85	85
8	15+15+20	R.68-1 FDD for 15MHz CC R.68 FDD for 20MHz CC	85	85	85
9	10+10+20	R.68-2 FDD for 10MHz CC R.68 FDD for 20MHz CC	85	85	85
10	10+15+15	R.68-2 FDD for 10MHz CC R.68-1 FDD for 15MHz CC	85	85	85
11	10+15+20	R.68-2 FDD for 10MHz CC R.68-1 FDD for 15MHz CC R.68 FDD for 20MHz CC	85	85	85
12	10+20+20	R.68-2 FDD for 10MHz CC R.68 FDD for 20MHz CC	85	85	85
13	20+20+20	R.68 FDD	85	85	85
Note 1: Note 2:	For 2 layer tran For the configu defined as TB s is the number of retransmitted D DL transport bloreceived DL transport block	ismissions, 2 transport blo ration of DRB type of Spli success rate = 100%*N _{DL} of newly transmitted DL tra DL transport blocks, and N ocks. All the above number insport blocks are calculates across all the CGs use	t bearer, the TB su _correct_rx/ (NDL_newtx + ansport blocks , ND DL_correct_rx is the nur ers of transmitted, I ted as the sum of the d for DC transmiss	ccess rate act NDL_retx), whe L_retx is the nui mber of correct retransmitted he numbers of ion or reception	mber of ctly received or correctly f DL on.
Note 3:	For the configured defined as TB s is the number of retransmitted DL transport blooms.	ration of DRB type of SCC success rate = 100%*N _{DL} of newly transmitted DL tra DL transport blocks, and N ocks. All the above number ansport blocks are calculated	G bearer, the TB su _correct_rx/ (NDL_newtx + ansport blocks, NDL _correct_rx is the numers of transmitted, i	uccess rate ac F N _{DL_retx}), whe _retx is the nun mber of correct retransmitted	eross CGs is ere N _{DL_newtx} nber of ctly received or correctly

transport blockes per CG used for DC transmission or reception, separately.

Table 8.7.6-5: Test points for sustained data rate (FRC DC 256QAM)

DC	Maximum supported Bandwidth	Cat. 11, 12	DL Cat.	DL Cat. 15		
config	combination (MHz)	DL Cat. 11,12	13			
	2x10	1	1	-		
	10+20	2	2	-		
DC with	2x15	3	3	-		
DC with 2CCs	15+20	4	4	-		
2005	2x20	5	5	-		
	10+15	6A	6A	-		
	15+5	6	6	-		
	15+20+20	7	5	7		
	15+15+20	8	4	8		
DC with	10+10+20	9	2	9		
DC with 3CCs	10+15+15	10	3	10		
3CCS	10+15+20	11	4	11		
	10+20+20	12	5	12		
	20+20+20	13	5	13		

8.7.7 TDD (DC)

The parameters specified in Table 8.7.7-1 are valid for all TDD DC tests unless otherwise stated.

Table 8.7.7-1: Common Test Parameters (TDD)

Parameter		Unit	Value
Uplink downlii	nk configuration		2 (Note 2)
Special subfra	me configuration		4
Cycli	c prefix		Normal
Ce	ell ID		0
Inter-TT	I Distance		1
	Q processes per ent carrier	Processes	7
Maximum number o	of HARQ transmission		4
Redundancy versi	on coding sequence		{0,0,1,2} for 64QAM and 256QAM
	symbols for PDCCH onent carrier	OFDM symbols	1
Cross carrie	er scheduling		Not configured
Propagation	on condition		Static propagation condition No external noise sources are applied
Transmis	sion mode		ТМЗ
Codebook su	bset restriction		10
Antenna c	onfiguration		2x2
$\hat{E}_{\scriptscriptstyle s}$ at antenna į	oort (dBm/15kHz)		-85
Symbols for	unused PRBs		OP.1 TDD
ACK/NACK f	eedback mode		Separate ACK/NACK feedbacks with PUCCH format 3 on the MCG and SCG
Time offset between MCG CC and SCG CC		μs	O for UE under test supporting synchronous dual connectivity; 500 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 1)
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3
allocation			-3
Note 1: Asynchro	σ	dB	0 y are defined in TS36.300 [11].

If the UE supports both SCG bearer and Split bearer, the Split bearer is configured. Note 2:

For UE not supporting 256QAM, the requirements are specified in Table 8.7.7-2, with the addition of the parameters in Table 8.7.7-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.7-3. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.7-4, with the addition of the parameters in Table 8.7.7-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.7-5. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.7-2 are not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3A.

Table 8.7.7-2: Minimum requirement (DC 64QAM)

Test number	Bandwidth combinatio n (MHz)	Number of bits of a DL-SCH transport block received within	Measurement channel	Reference value TB success rate across CG		CGs(%)
		a TTI		DRB type of Split bearer		e of SCG (Note 3)
				(Note 2)	MCG	SCG
1	2x20	75376/0 (Note 4)	R.31-4A TDD	85	85	85
2	3x20	75376/0 (Note 4)	R.31-4A TDD	85	85	85
3	4x20	75376/0 (Note 4)	R.31-4A TDD	85	85	85
4	15+3x20	55056/0 for 15MHz CC 75376/0 for 20MHz CC (Note 4)	R.31-5 TDD for 15MHz CC R.31-4 TDD for 20MHz CC	85	85	85

Note 2: For the configuration of DRB type of Split bearer, the TB success rate across CGs is defined as TB success rate = 100%*NDL_correct_rx/ (NDL_newtx + NDL_retx), where NDL_newtx is the number of newly transmitted DL transport blocks, NDL_retx is the number of retransmitted DL transport blocks, and NDL_correct_rx is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.

Note 3: For the configuration of DRB type of SCG bearer, the TB success rate across CGs is defined as TB success rate = 100%*NDL_correct_rx/ (NDL_newtx + NDL_retx), where NDL_newtx is the number of newly transmitted DL transport blocks, NDL_retx is the number of retransmitted DL transport blocks, and NDL_correct_rx is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately.

Note 4: 71112 bits for sub-frame 5.

Table 8.7.7-3: Test points for sustained data rate (FRC DC 64QAM)

DC	Maximum supported	0-1.0	0-1.4	0-1 0 7	0-1 0 40	Cat. 11, 12	DI 0-145
config	Bandwidth combination (MHz)	Cat. 3 Cat. 4		Cat. 6, 7	Cat. 9, 10	DL Cat. 11, 12	DL Cat.15
DC with 2CCs	2x20	-	-	1	1	-	-
DC with 3CCs	3x20	-	-	1	2	2	-
DC with	4x20	-	-	-	2	3	3
4CCs	15+3x20	-	-	-	2	4	4

Table 8.7.7-4: Minimum requirement (DC 256QAM)

Test number	Bandwidth combination (MHz)	Measurement channel	Reference value TB success rate (%)							
			DRB type of	DRB type						
			Split bearer	bearer (
			(Note 2)	MCG	SCG					
1	2x20	R.68-3 TDD	85	85	85					
Note 1:	For 2 layer tran	smissions, 2 transport blocks a	re received within	a TTI.						
Note 2:	defined as TB s is the number of retransmitted D DL transport blo received DL tra transport blocks	For 2 layer transmissions, 2 transport blocks are received within a TTI. For the configuration of DRB type of Split bearer, the TB success rate across CGs is defined as TB success rate = 100%*NDL_correct_rx/ (NDL_newtx + NDL_retx), where NDL_newtx is the number of newly transmitted DL transport blocks, NDL_retx is the number of retransmitted DL transport blocks, and NDL_correct_rx is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.								
Note 3:	defined as TB s	ration of DRB type of SCG bear success rate = 100%*N _{DL_correct_} of newly transmitted DL transpo	rx/ (N _{DL_newtx} + N _{DL}	_retx), where I	N _{DL_newtx}					

retransmitted DL transport blocks, and N_{DL_correct_rx} is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately.

Table 8.7.7-5: Test points for sustained data rate (FRC DC 256QAM)

DC config	Maximum supported Bandwidth	Cat. 11, 12	DL Cat. 13	DL Cat. 15	DL Cat. 16	
Comig	combination (MHz)	DL Cat. 11, 12				
DC with 2CCs	2x20	1	1	-	-	
DC with 3CCs	3x20	2	1	2	-	
DC with	4x20	2	-	3	3	
4CCs	15+3x20	2	-	4	4	

8.7.8 TDD FDD (DC)

The parameters specified in Table 8.7.8-1 are valid for all TDD FDD DC tests unless otherwise stated.

Table 8.7.8-1: Common Test Parameters (TDD FDD DC)

	meter	Unit	Value
. (onfiguration for TDD CC		2 (Note 2)
	configuration for TDD CC		4
Cyclic	c prefix		Normal
Сє	II ID		0
Inter-TT	I Distance		1
	Q processes per ent carrier	Processes	8 for FDD CC; 7 for TDD CC
Maximum number o	of HARQ transmission		4
Redundancy versi	on coding sequence		{0,0,1,2} for 64QAM and 256QAM
	symbols for PDCCH onent carrier	OFDM symbols	1
Cross carrie	er scheduling		Not configured
Propagation	on condition		Static propagation condition No external noise sources are applied
Transmis	sion mode		TM3
Codebook su	bset restriction		10
Antenna c	onfiguration		2x2
$\hat{E}_{\scriptscriptstyle s}$ at antenna ${}_{\scriptscriptstyle m I}$	oort (dBm/15kHz)		-85
Symbols for	unused PRBs		OP.1 TDD for TDD CC; OP.1 FDD for FDD CC
ACK/NACK f	eedback mode		Separate ACK/NACK feedbacks with PUCCH format 3 on the MCG and SCG
Time offset between MCG CC and SCG CC		μѕ	0 for UE under test supporting synchronous dual connectivity; 500 for UE under test supporting both asynchronous and synchrounous dual connectivity (Note 1)
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
	σ	dB	0

For UE not supporting 256QAM, the requirements are specified in Table 8.7.8-2, with the addition of the parameters in Table 8.7.8-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.8-3. The TB success rate shall be sustained during at least 300 frames.

For UE supporting 256QAM, the requirements are specified in Table 8.7.8-4, with the addition of the parameters in Table 8.7.7-1 and the downlink physical channel setup according to Annex C.3.2. The test points are applied to UE category and bandwidth combination with maximum aggregated bandwidth as specified in Table 8.7.8-5. The TB success rate shall be sustained during at least 300 frames. For UE supporting 256QAM, the requirements in Table 8.7.8-2 are not applicable.

The applicability of ther requirements are specified in Clause 8.1.2.3A.

Table 8.7.8-2: Minimum requirement (TDD FDD DC 64QAM)

				Number of bits of a DL-SCH transport block received within				Reference value TB success rate across CGs(%)		
Test num ber	Bandwidth (MHz)			a TTI (for normal/special subframe for TDD, except for subframe		Measurement channel		DRB type of Split	DRB type of SCG bearer (Note 3)	
		r	r	#5)				bearer (Note 2)	M00	000
	Total	FDD CC	TDD CC	FDD CC	TDD CC	FDD CC TDD CC		(14010 2)	MCG	SCG
1	2x20	20	20	75376 (Note 4)	75376/0 (Note 4)	R.31-4 FDD	R.31-4A TDD	85	85	85

Note 2: For the configuration of DRB type of Split bearer, the TB success rate across CGs is defined as TB success rate = 100%*NDL_correct_rx/ (NDL_newtx + NDL_retx), where NDL_newtx is the number of newly transmitted DL transport blocks, NDL_retx is the number of retransmitted DL transport blocks, and NDL_correct_rx is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC transmission or reception.

Note 3: For the configuration of DRB type of SCG bearer, the TB success rate across CGs is defined as TB success rate = 100%*N_{DL_correct_rx}/ (N_{DL_newtx} + N_{DL_retx}), where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport blocks, and N_{DL_correct_rx} is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes per CG used for DC transmission or reception, separately.

Note 4: 71112 bits for sub-frame 5.

Table 8.7.8-3: Test points for sustained data rate (FRC TDD FDD DC 64QAM)

CA config	Maximum sı	upported Bandwi combination (MI	Cat. 6,	Cat. 9.10		
	Total	FDD CC	TDD CC	,	9,10	
DC with 2CCs	2x20	20	20	1	1	

Table 8.7.8-4: Minimum requirement (TDD FDD DC 256QAM)

						Reference value TB success rate across CGs(%)			
Test num ber	Bandwidth (MHz)		Measu cha	rement nnel	DRB type of Split	DRB type of SCG bearer (Note 3)			
	Total FDD TDD CC CC				bearer				
			FDD CC	TDD CC	(Note 2)	MCG	SCG		

1	2x20	20	20	R.68 FDD	R.68-3 TDD	85	85	85				
Note 1:	For 2	For 2 layer transmissions, 2 transport blocks are received within a TTI.										
Note 2:						r, the TB succ						
	is def	is defined as TB success rate = 100%*N _{DL_correct_rx} / (N _{DL_newtx} + N _{DL_retx}), where										
		N _{DL_newtx} is the number of newly transmitted DL transport blocks, N _{DL_retx} is the										
		number of retransmitted DL transport blocks, and N _{DL_correct_rx} is the number of										
		orrectly received DL transport blocks. All the above numbers of transmitted,										
		retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blockes across all the CGs used for DC										
					kes across a	ıll the CGs use	ed for DC					
		mission o										
Note 3:						r, the TB succ						
						_rx/ (N _{DL_newtx} +						
						ransport block						
						d N _{DL_correct_rx} i						
						ove numbers						
		retransmitted or correctly received DL transport blocks are calculated as the sum										
		of the numbers of DL transport blockes per CG used for DC transmission or reception, separately.										
	recep	nion, sep	arately.									

Table 8.7.8-5: Test points for sustained data rate (FRC TDD FDD DC 256QAM)

СА	Maximum su Bandwidth	ipported Ba combinatio		Cat. 11, 12	DL Cat.		
config	Total	FDD CC	TDD CC	DL Cat. 11, 12	13		
DC	2x20	20	20	1	1		
with							
2CCs	•						

Note 1: If DL category is signalled by the UE under test, then select the test point according to UE DL Category. Otherwise, select the test point according to the UE category signalled.

8.7.9 Void

Table 8.7.9-1: Void

Table 8.7.9-2: Void

Table 8.7.9-3: Void

Table 8.7.9-4: Void

Table 8.7.9-5: Void

8.7.10 Void

Table 8.7.10-1: Void

Table 8.7.10-2: Void

Table 8.7.10-3: Void

Table 8.7.10-4: Void

Table 8.7.10-5: Void

8.7.11 Void

Table 8.7.11-1: Void

8.7.11.1 Void

Table 8.7.11.1-1: Void

Table 8.7.11.1-2: Void

Table 8.7.11.1-3: Void

Table 8.7.11.1-4: Void

8.8 Demodulation of EPDCCH

The receiver characteristics of the EPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). For the distributed transmission tests in 8.8.1, EPDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of EPDCCH. For other tests, EPDCCH and PCFICH are not tested jointly.

8.8.1 Distributed Transmission

8.8.1.1 FDD

The parameters specified in Table 8.8.1.1-1 are valid for all FDD distributed EPDCCH tests unless otherwise stated.

Table 8.8.1.1-1: Test Parameters for Distributed EPDCCH

Parame	Parameter						
Number of PDCCH syr	mbols	symbols	2 (Note 1)				
PHICH duration			Normal				
Unused RE-s and PRE	3-s		OCNG				
Cell ID			0				
	$ ho_{\scriptscriptstyle A}$	dB	-3				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3				
allocation	σ	dB	0				
	δ	dB	3				
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98				
Cyclic prefix			Normal				
Subframe Configuratio	Subframe Configuration						
Precoder Update Gran	ularity	PRB	1				
Frecoder Opdate Gran	ulanty	ms	1				
Beamforming Pre-Cod	er		Annex B. 4.4				
Cell Specific Reference			Port 0 and 1				
Number of EPDCCH S	ets Configured		2 (Note 2)				
Number of PRB per EF	PDCCH Set		4 (1 st Set) 8 (2 nd Set)				
EPDCCH Subframe M	onitoring		NA				
PDSCH TM			TM3				
DCI Format			2A				
PCFICH. RI configured.	symbol for EPDCC RC signalling <i>epdccl</i>	h-StartSymb	ool-r11 is not				
overlapping PRB = {0, 7 EPDCCH is	s are distributed EPI with PRB = {3, 17, 3, , 14, 21, 28, 35, 42, scheduled in the firs 2, respectively. Both	31, 45} for th 49} for the s st set for Te	ne first set and second set. st 1 and second				

For the parameters specified in Table 8.8.1.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.1-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.1.1-2: Minimum performance Distributed EPDCCH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	2.60
2	10 MHZ	16 ECCE	R.56 FDD	OP.7 FDD	EVA70	2 x 2 Low	1	-3.20

8.8.1.1.1 Void

Table 8.8.1.1.1-1: Void

8.8.1.2 TDD

The parameters specified in Table 8.8.1.2-1 are valid for all TDD distributed EPDCCH tests unless otherwise stated.

Table 8.8.1.2-1: Test Parameters for Distributed EPDCCH

	Parame	Unit	Value				
Number	of PDCCH syr	symbols	2 (Note 1)				
PHICH d	uration		Normal				
Unused F	RE-s and PRB		OCNG				
Cell ID			0				
		$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink allocation		$ ho_{\scriptscriptstyle B}$	dB	-3			
allocation		σ	dB	0			
		δ	dB	3			
$N_{\it oc}$ at a	ntenna port	dBm/15 kHz	-98				
Cyclic pro			Normal				
Subframe	e Configuration		Non-MBSFN				
Precoder Update Granularity			PRB	1			
			ms	1			
	ming Pre-Code		Annex B. 4.4				
	cific Reference		Port 0 and 1				
Number	of EPDCCH S		2 (Note 2)				
Number	of PRB per EF		4 (1 st Set) 8 (2 nd Set)				
EPDCCH	Subframe Me		NA				
PDSCH ⁻	ГМ		TM3				
DCI Forn	nat		2A				
TDD UL/	DL Configurat		0				
TDD Spe	cial Subframe		1 (Note 3)				
Note 1:	The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling <i>epdcch-StartSymbol-r11</i> is not configured.						
Note 2:	The two sets are distributed EPDCCH sets and non- overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured. Demodulation performance is averaged over normal and						
special subframe.							

For the parameters specified in Table 8.8.1.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.1.2-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.1.2-2: Minimum performance Distributed EPDCCH

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	Reference value	
number		level	Channel	Pattern	Condition	configuration and correlation	Pm-dsg (%)	SNR (dB)	
						Matrix	(/0)	(ub)	
1	10 MHz	4 ECCE	R.55 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	2.80	
2	10 MHZ	16 ECCE	R.56 TDD	OP.7 TDD	EVA70	2 x 2 Low	1	-3.10	

8.8.1.2.1 Void

Table 8.8.1.2.1-1: Void

8.8.2 Localized Transmission with TM9

8.8.2.1 FDD

The parameters specified in Table 8.8.2.1-1 are valid for all FDD TM9 localized ePDCCH tests unless otherwise stated.

Table 8.8.2.1-1: Test Parameters for Localized EPDCCH with TM9

Param	eter	Unit	Value
Number of PDCCH sy	mbols	symbols	1 (Note 1)
EPDCCH starting sym	bol	symbols	2 (Note 1)
PHICH duration			Normal
Unused RE-s and PRI	3-s		OCNG
Cell ID			0
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	σ	dB	-3
	δ	dB	0
$N_{\it oc}$ at antenna port			-98
Cyclic prefix			Normal
Subframe Configuration	Subframe Configuration		Non-MBSFN
Proceder Undate Gran	Precoder Update Granularity		1
•		ms	1
Beamforming Pre-Coo			Annex B.4.5
Cell Specific Reference			Port 0 and 1
CSI-RS Reference Sig			Port 15 and 16
CSI-RS reference sigr configuration			0
CSI reference signal s configuration I _{CSI-RS}	ubframe		2
ZP-CSI-RS configurat	ion bitmap		000001000000000
ZP-CSI-RS subframe			2
CSI-RS	-		Z
Number of EPDCCH S	Sets		2 (Note 2)
EPDCCH Subframe M			111111110 111111101 1111111011
subframePatternConfi	g-r11		1111110111 (Note 3)
PDSCH TM			TM9
Note 1: The starting	symbol for EPDC	CH is signalled	with epdcch-StartSymbol-r11. However, CFI is

- Note 1: The starting symbol for EPDCCH is signalled with *epdcch-StartSymbol-r11*. However, CFI is set to 1.
- Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set for all tests.
- Note 3: EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search space only in SFs configured by *subframePatternConfig-r11*. Legacy PDCCH is not scheduled.

For the parameters specified in Table 8.8.2.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.2.1-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.2.1-2: Minimum performance Localized EPDCCH with TM9

Ī	Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
	number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
l	1	10 MHz	2 ECCE	R.57 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	12.2
ſ	2	10 MHZ	8 ECCE	R.58 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	2.5

8.8.2.1.1 Void

Table 8.8.2.1.1-1: Void

8.8.2.1.2 Void

Table 8.8.2.1.2-1: Void

Table 8.8.2.1.2-2: Void

Table 8.8.2.1.2-3: Void

8.8.2.2 TDD

The parameters specified in Table 8.8.2.2-1 are valid for all TDD TM9 localized ePDCCH tests unless otherwise stated.

Table 8.8.2.2-1: Test Parameters for Localized EPDCCH with TM9

Paramet	er	Unit	Value
Number of PDCCH syml	ools	symbols	1 (Note 1)
EPDCCH starting symbol	ol	symbols	2 (Note 1)
PHICH duration			Normal
Unused RE-s and PRB-s	3		OCNG
Cell ID			0
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	σ	dB	-3
	δ	dB	0
N_{oc} at antenna port		dBm/15 kHz	-98
Cyclic prefix			Normal
Subframe Configuration			Non-MBSFN
Precoder Update Granul	arity	PRB	1
·		ms	1
Beamforming Pre-Coder			Annex B.4.5
Cell Specific Reference			Port 0 and 1
CSI-RS Reference Signa			Port 15 and 16
CSI-RS reference signal configuration	resource		0
CSI reference signal sub configuration I _{CSI-RS}	frame		0
ZP-CSI-RS configuration	n bitmap		000001000000000
ZP-CSI-RS subframe co	nfiguration I _{ZP} -		0
Number of EPDCCH Se	ts		2 (Note 2)
EPDCCH Subframe Monitoring pattern subframePatternConfig-r11			1100011000 1100010000 1100011000 1100001000 1100011000 1000011000 1100011000 (Note 3)
PDSCH TM			TM9
TDD UL/DL Configuration	n		0
TDD Special Subframe			1 (Note 4)

- The starting symbol for EPDCCH is signalled with epdcch-StartSymbol-r11. However, CFI is Note 1: set to 1.
- Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set for all tests.
- EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search Note 3: space only in SFs configured by subframePatternConfig-r11. Legacy PDCCH is not scheduled.

Demodulation performance is averaged over normal and special subframe. Note 4:

For the parameters specified in Table 8.8.2.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.2.2.2-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.2.2-2: Minimum performance Localized EPDCCH with TM9

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referenc	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	2 ECCE	R.57 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	12.8
2	10 MHZ	8 ECCE	R.58 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	2.0

8.8.2.2.1 Void

Table 8.8.2.2.1-1: Void

8.8.2.2.2 Void

Table 8.8.2.2.2-1: Void

Table 8.8.2.2.2: Void

Table 8.8.2.2.2-3: Void

8.8.3 Localized transmission with TM10 Type B quasi co-location type

8.8.3.1 FDD

For the parameters specified in Table 8.8.3.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.1-2. In Table 8.8.3.1-1, transmission point 1 (TP 1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.3.1-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

			Te	est 1	Tes	st 2
	rameter	Unit	TP 1	TP 2	TP 1	TP 2
PHICH durati					ormal	
Downlink	$\rho_{\scriptscriptstyle A}$	dB			0	
power	$\rho_{\scriptscriptstyle B}$	dB			0	
allocation	σ	dB			-3	
	δ	dB	OdD power		0	
\hat{E}_s/N_{oc}		dB	0dB power imbalance is considered between TP 1 and TP 2,	Reference value in Table 8.8.3.1-	Reference value in Table 8.8.3.1-	Reference value in Table 8.8.3.1-
$N_{\it oc}$ at anten	na port	dBm/ 15kH z		-	98	
Bandwidth		MHz	10	10	10	10
Number of co EPDCCH Set	ts		2 (N	lote 1)	2 (N	ote1)
EPDCCH-PR (setConfigld)			0	1	0	1
PRB-set	type of EPDCCH-		Localized	Localized	Localized	Localized
Number of PI EPDCCH-PR	B-set	PRB	8	8	8	8
	amforming model		Annex B.4.5	Annex B.4.5	Annex B.4.5	Annex B.4.5
PDSCH trans	smission mode		TM10	TM10	TM10 Probability of	TM10 Probability of
PDSCH trans	PDSCH transmission scheduling		Blanked in all the subframes	Transmit in all the subframes	occurrence of PDSCH transmission is 30% (Note 3)	occurrence of PDSCH transmission is 70% (Note 3)
Non-zero power CSI	CSI reference signal configuration		N/A	0	N/A	0
reference signal (NZPId=1)	CSI reference signal subframe configuration IcsI-RS		N/A	2	N/A	2
Non-zero power CSI	CSI reference signal configuration		N/A	N/A	10	N/A
reference signal (NZPId=2)	CSI reference signal subframe configuration Icsi-RS		N/A	N/A	2	N/A
Zero power CSI reference	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	0000010000000	N/A	1000010000000
signal (ZPId=1)	CSI-RS subframe configuration <i>I</i> csi-RS		N/A	2	N/A	2
Zero power CSI reference	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	N/A	1000010000000 000	N/A
signal (ZPId=2)	CSI-RS subframe configuration I _{CSI-RS}		N/A	N/A	2	N/A
PQI set 0 (Note 4)	Non-Zero power CSI RS Identity (NZPId)		N/A	1	N/A	1

	Zero power CSI RS Identity (ZPId)		N/A	1	N/A	1		
PQI set 1	Non-Zero power CSI RS Identity (NZPId)		N/A	N/A	2	N/A		
(Note 4)	Zero power CSI RS Identity (ZPId)		N/A	N/A	2	N/A		
Number of P	DCCH symbols	Symb ols		1 (Note 2)				
EPDCCH sta	arting position		pdsch-Start- r11=2 (Note 2)					
Subframe co	nfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN		
Time offset b	etween TPs	μs	N/A	2	N/A	2		
Frequency sl	hift between TPs	Hz	N/A	200	N/A	200		
Cell ID	·		0	126	0	126		

- Note 1: Resource blocks n_{PRB} =0, 7, 14, 21, 28, 35, 42, 49 are allocated for both the first set and the second set.
- Note 2: The starting OFDM symbol for EPDCCH is determined from the higher layer signalling pdsch-Start-r11. And CFI is set to 1.
- Note 3: The TP from which PDSCH is transmitted shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TP 1 and TP 2 are specified.
- Note 4: For PQI set 0, PDSCH and EPDCCH are transmitted from TP 2. For PQI set 1, PDSCH and EPDCCH are transmitted from TP1. EPDCCH and PDSCH are transmitted from same TP.

Table 8.8.3.1-2: Minimum Performance

ſ	Test	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
	number	level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
	1	2 ECCE	R.59 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	13.4
	2	2 ECCE	R.59 FDD	OP.7 FDD	EVA5	2 x 2 Low	1	13.4

8.8.3.2 TDD

For the parameters specified in Table 8.8.3.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified values in Table 8.8.3.2-2. In Table 8.8.3.2-1, transmission point 1 (TP1) is the serving cell. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.8.3.2-1: Test Parameters for Localized Transmission TM10 Type B quasi co-location type

D-	Parameter		Te	est 1	Tes	st 2		
		Unit	TP 1	TP 2	TP 1	TP 2		
PHICH durati					rmal			
Downlink	$ ho_{\scriptscriptstyle A}$	dB			0			
power	$ ho_{\scriptscriptstyle B}$	dB			0			
allocation	σ	dB			-3			
	δ	dB	0.15	Г	0	Г		
\hat{E}_s/N_{oc}		dB	0dB power imbalance is considered between TP 1 and TP 2,	Reference value in Table 8.8.3.2-	Reference value in Table 8.8.3.2-2	Reference value in Table 8.8.3.2-2		
$N_{\it oc}$ at anten	na port	dBm/ 15kH z	-98					
Bandwidth		MHz	10	10	10	10		
Number of El			2 (N	ote 1)	2 (No	ote1)		
EPDCCH-PR (setConfigld)			0	1	0	1		
Transmission type of EPDCCH-PRB-set			Localized	Localized	Localized	Localized		
EPDCCH-PR	Number of PRB pair per EPDCCH-PRB-set EPDCCH beamforming model		8	8	8	8		
			Annex B.4.5 TM10	Annex B.4.5 TM10	Annex B.4.5 TM10	Annex B.4.5 TM10		
PDSCH transmission mode PDSCH transmission scheduling			Blanked in all the subframes	Transmit in all the subframes	Probability of occurrence of PDSCH transmission is 30% (Note 3)	Probability of occurrence of PDSCH transmission is 70% (Note 3)		
CSI reference configuration	s		Antenna ports 15,16	Antenna ports 15,16	Antenna ports 15,16	Antenna ports 15,16		
Non-zero power CSI	CSI reference signal configuration		N/A	0	N/A	0		
reference signal (NZPId=1)	CSI reference signal subframe configuration I _{CSI-RS}		N/A	0	N/A	0		
Non-zero power CSI	CSI reference signal configuration		N/A	N/A	10	N/A		
reference signal (NZPId=2)	CSI reference signal subframe configuration I _{CSI-RS}		N/A	N/A	0	N/A		
Zero power CSI reference	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	0000010000000 000	N/A	1000010000000		
signal (ZPId=1)	CSI-RS subframe configuration I _{CSI-RS}		N/A	0	N/A	0		
Zero power CSI reference	CSI-RS Configuration list (ZeroPowerCSI- RS bitmap)	Bitma p	N/A	N/A	1000010000000	N/A		
signal (ZPId=2)	CSI-RS subframe configuration I _{CSI-RS}		N/A	N/A	0	N/A		

PQI set 0	Non-Zero power CSI RS Identity (NZPId)		N/A	1	N/A	1			
(Note 4)	Zero power CSI RS Identity (ZPId)		N/A	1	N/A	1			
PQI set 1	Non-Zero power CSI RS Identity (NZPId)		N/A	N/A	2	N/A			
(Note 4)	Zero power CSI RS Identity (ZPId)		N/A N/A		2	N/A			
Number of P	Number of PDCCH symbols Sym			1 (Note 2)					
	arting position		pdsch-Start- r11=2 (Note 2)	pdsch-Start- pdsch-Start- pdsch-Start-) r11=2 (Note 2) r11=2 (Note 2) r11=2 (Note					
Subframe co	nfiguration		Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN			
Time offset b	etween TPs	μs	N/A	2	N/A	2			
Frequency sl	hift between TPs	Hz	N/A	200	N/A	200			
Cell ID			0	126	0	126			
TDD UL/DL	configuration		0						
TDD special	subframe				1				

- Note 1: Resource blocks $n_{PRB} = 0, 7, 14, 21, 28, 35, 42, 49$ are allocated for both the first set and the second set.
- Note 2: The starting OFDM symbol for EPDCCH is determined from the higher layer signalling pdsch-Start-r11.

 And CFI is set to 1.
- Note 3: The TP from which PDSCH is transmitted shall be randomly determined independently for each subframe. Probabilities of occurrence of PDSCH transmission from TP 1 and TP 2 are specified.
- Note 4: For PQI set 0, PDSCH and EPDCCH are transmitted from TP 2. For PQI set 1, PDSCH and EPDCCH are transmitted from TP1. EPDCCH and PDSCH are transmitted from same TP.

Table 8.8.3.2-2: Minimum Performance

Test	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number	level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	2 ECCE	R.59 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	13.6
2	2 ECCE	R.59 TDD	OP.7 TDD	EVA5	2 x 2 Low	1	13.6

8.8.4 Enhanced Downlink Control Channel Performance Requirements Type A - Localized Transmission with CRS Interference Model

8.8.4.1 FDD

For the parameters specified in Table 8.8.4.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.4.1-2. The purpose of this test is to verify the localized EPDCCH performance, when the EPDCCH transmission in the serving cell is interfered by the CRS of the interfering cells, applying the CRS interference model defined in clause B.6.5. In Table 8.8.4.1-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical setup is in accordance with Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.8.4.1-1: Test Parameters for EPDCCH

Parameter		Unit	Cell 1	Cell 2	Cell 3
Number of PDCCH symbols		symbols	1 (Note 1)	2	2
EPDCCH starting symbol		symbols	2 (Note 1)	N/A	N/A
PHICH duration			Normal	Normal	Normal
Unused RE-s and PRB-s			OCNG	N/A	N/A
Cell ID	Cell ID		0	1	6
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3	-3
·	σ	dB	-3	0	0
	δ	dB	0	0	0
Cell-specific reference signal	S		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port		dBm/15kHz	0,1	-98	0,1
\hat{E}_s/N_{oc}	dB	N/A	13.91	3.34	
BW _{Channel}	MHz	10	10	10	
Cyclic Prefix		Normal	Normal	Normal	
Subframe Configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
		PRB	1	N/A	N/A
EPDCCH Precoder Update G	EPDCCH Precoder Update Granularity		1	N/A	N/A
EPDCCH Beamforming Pre-Coder			Annex B. 4.5	N/A	N/A
CSI-RS Reference Signal			Port 15 and 16	N/A	N/A
CSI-RS reference signal reso	ource		0	N/A	N/A
CSI reference signal subfram configuration Icsi-RS	е		2	N/A	N/A
ZP-CSI-RS configuration bitn	nap		000001000000	N/A	N/A
ZP-CSI-RS subframe configu	ration Izp-CSI-		2	N/A	N/A
Number of EPDCCH Sets			1	N/A	N/A
EPDCCH Set type			Localized	N/A	N/A
Number of PRB per EPDCCh	l Set		8	N/A	N/A
EPDCCH Set PRBs			0, 7, 14, 21, 28, 35, 42, 49	N/A	N/A
PDSCH TM			TM9	N/A	N/A
Interference model			N/A	As specified in clause B.6.5	As specified in clause B.6.5
Time offset to cell 1		μs	N/A	2	3
Frequency offset to cell 1		Hz	N/A	200	300
Note 1: The starting symbol	ol for EPDCCH				

Note 1: The starting symbol for EPDCCH is signalled with epdcch-StartSymbol-r11. CFI is set to 1.

Note 2: EPDCCH is scheduled in every subframe. EPDCCH Subframe Monitoring pattern is not configured.

Table 8.8.4.1-2: Minimum performance for EPDCCH for enhanced downlink control channel performance requirements Type A

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration Pm-dsg		SNR
						and correlation	(%)	(dB)
						Matrix		
1	10 MHz	2 ECCE	R.57 FDD	OP.7 FDD	EPA5	2 x 2 Low	1	13.4

8.8.4.2 TDD

For the parameters specified in Table 8.8.4.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.4.2-2. The purpose of this test is to verify the localized EPDCCH performance, when the EPDCCH transmission in the serving cell is interfered by the CRS of the interfering cells, applying the CRS interference model defined in clause B.6.5. In Table 8.8.4.2-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical setup is in accordance with Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.8.4.2-1: Test Parameters for EPDCCH

Parameter		Unit	Cell 1	Cell 2	Cell 3
Number of PDCCH symbols		symbols	1 (Note 1)	2	2
EPDCCH starting symbol		symbols	2 (Note 1)	N/A	N/A
PHICH duration			Normal	Normal	Normal
Unused RE-s and PRB-s			OCNG	N/A	N/A
Cell ID			0	1	6
	$ ho_{\scriptscriptstyle A}$	dB	0	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3	-3
·	σ	dB	-3	0	0
	δ	dB	0	0	0
Cell-specific reference signals	3		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N _{oc} at antenna port		dBm/15kHz	,	-98	,
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34
BW _{Channel}		MHz	10	10	10
Cyclic Prefix			Normal	Normal	Normal
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN
•		PRB	1	N/A	N/A
EPDCCH Precoder Update G	ranularity	ms	1	N/A	N/A
EPDCCH Beamforming Pre-0		Annex B. 4.5	N/A	N/A	
CSI-RS Reference Signal			Port 15 and 16	N/A	N/A
CSI-RS reference signal reso configuration	urce		0	N/A	N/A
CSI reference signal subfram configuration Icsi-RS	е		2	N/A	N/A
ZP-CSI-RS configuration bitm	ар		000001000000 0000	N/A	N/A
ZP-CSI-RS subframe configu	ration Izp-csi-		2	N/A	N/A
Number of EPDCCH Sets			1	N/A	N/A
EPDCCH Set type			Localized	N/A	N/A
Number of PRB per EPDCCH	l Set		8	N/A	N/A
EPDCCH Set PRBs			0, 7, 14, 21, 28, 35, 42, 49	N/A	N/A
PDSCH TM			TM9	N/A	N/A
Interference model			N/A	As specified in clause B.6.5	As specified in clause B.6.5
Time offset to cell 1	μS	N/A	2	3	
Frequency offset to cell 1		Hz	N/A	200	300
TDD UL/DL Configuration		112	0	0	0
TDD Special Subframe			1 (Note 4)	1	1
122 Opoolal Subilatio	14 5550011	 	1 (11010 -1)	<u> </u>	<u>'</u>

The starting symbol for EPDCCH is signalled with epdcch-StartSymbol-r11. CFI is set to 1. Note 1:

EPDCCH is scheduled in every subframe. EPDCCH Subframe Monitoring pattern is not configured. Demodulation performance is averaged over normal and special subframes. Note 2:

Note 3:

Table 8.8.4.2-2: Minimum performance for EPDCCH for enhanced downlink control channel performance requirements Type A

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referenc	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
						IVIALITA		
1	10 MHz	2 ECCE	R.57 TDD	OP.7 TDD	EPA5	2 x 2 Low	1	14.2

8.8.5 Enhanced Downlink Control Channel Performance Requirements Type A - Distributed Transmission with TM9 Interference Model

8.8.5.1 TDD

For the parameters specified in Table 8.8.5.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.5.1-2. The purpose of this test is to verify the distributed EPDCCH performance when the EPDCCH transmission in the serving cell is interfered by two interfering cells and applying TM9 interference model. In Table 8.8.5.1-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical setup is in accordance with Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is provided and includes Cell 2 and Cell 3.

Table 8.8.5.1-1: Test Parameters for EPDCCH

Parameter		Unit	Cell 1	Cell 2	Cell 3
Number of PDCCH symbols		symbols	2 (Note 1)	2	2
PHICH duration			Normal	Normal	Normal
Cell ID			0	6	1
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
Downlink power allocation	σ	dB	0	0	0
	δ	dB	3	3	3
Cell-specific reference signal	S		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port		dBm/15kHz		-98	
\hat{E}_s/N_{oc}		dB	N/A	13.91	3.34
BW _{Channel}		MHz	10	10	10
Cyclic Prefix		Normal	Normal	Normal	
Subframe Configuration		Non-MBSFN	Non-MBSFN	Non-MBSFN	
		PRB	1	N/A	N/A
EPDCCH precoder Update G	oranulanty	ms	1	N/A	N/A
Beamforming Pre-Coder			Annex B. 4.4	N/A	N/A
Number of EPDCCH Sets Co	onfigured		1	N/A	N/A
EPDCCH Set type			Distributed	N/A	N/A
Number of PRB per EPDCCH	H Set		4	N/A	N/A
EPDCCH Set PRBs			3, 17, 31, 45	N/A	N/A
PDSCH TM			TM9	N/A	N/A
Interference model			N/A	As specified in clause B.5.4	As specified in clause B.5.4
Probability of occurrence of PDSCH transmission rank in	Rank 1	%	N/A	70	70
interfering cells	D = I- O		N/A	30	30
PDSCH precoder update gra	PRB	N/A	50	50	
Time offset to cell 1	μs	N/A	2	3	
Frequency offset to cell 1	Hz	N/A	200	300	
TDD UL/DL Configuration			0	0	0
TDD Special Subframe			1 (Note 3)	1	1
No. 4 The Control of	55500011		L BOEIGH BBO	, ,	<u> </u>

Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling *epdcch-StartSymbol-r11* is not configured.

Note 2: EPDCCH is scheduled in every subframe. EPDCCH Subframe Monitoring pattern is not configured.

Note 3: Demodulation performance is averaged over normal and special subframes.

Table 8.8.5.1-2: Minimum performance for EPDCCH for enhanced downlink control channel performance requirements Type A

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referenc	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55-1	OP.7 TDD	EPA5	2 x 2 Low	1	14.8
			TDD					

8.8.6 Enhanced Downlink Control Channel Performance Requirements Type A - Distributed Transmission with TM3 Interference Model

8.8.6.1 FDD

For the parameters specified in Table 8.8.6.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.8.6.1-2. The purpose of this test is to verify the distributed EPDCCH performance when the serving cell EPDCCH transmission is interfered by two interfering cells applying asynchronous TM3 interference model. In Table 8.8.6.1-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggressor cells. The downlink physical setup is in accordance with Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively. The CRS assistance information [7] is not provided.

Table 8.8.6.1-1: Test Parameters for EPDCCH

Parameter		Unit	Cell 1	Cell 2	Cell 3
Number of PDCCH symbols	symbols	2 (Note 1)	2	2	
PHICH duration		Normal	Normal	Normal	
Cell ID			0	1	6
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
Downlink power anocation	σ	dB	0	0	0
	δ	dB	3	0	0
Cell-specific reference signal	5		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port		dBm/15kHz		-98	
\hat{E}_s/N_{oc}	dB	N/A	13.91	3.34	
BWChannel	MHz	10	10	10	
Cyclic Prefix		Normal	Normal	Normal	
Subframe Configuration			Non-MBSFN	Non-MBSFN	Non-MBSFN
EDDCCH Broader Undete C	ropularity	PRB	1	N/A	N/A
EPDCCH Precoder Update G	iranulanty	ms	1	N/A	N/A
EPDCCH Beamforming Pre-0	Coder		Annex B.4.4	N/A	N/A
Number of EPDCCH Sets Co	nfigured		1	N/A	N/A
EPDCCH Set type			Distributed	N/A	N/A
Number of PRB per EPDCCH	l Set		4	N/A	N/A
EPDCCH Set PRBs			3, 17, 31, 45	N/A	N/A
PDSCH TM			TM9	N/A	N/A
Interference model				As specified in clause B.5.2	As specified in clause B.5.2
Probability of occurrence of PDSCH transmission rank in			N/A	70	70
interfering cells Rank 2		%	N/A	30	30
Time offset to cell 1	μs	N/A	330	667	
Frequency offset to cell 1		Hz	N/A	0	0
Note 1: The starting symbol	ol for EPDCCH	is derived from t	he PCFICH_RRC	signalling endcch	-StartSymbol-

Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling *epdcch-StartSymbol-r11* is not configured.

Note 2: EPDCCH is scheduled in every subframe. EPDCCH Subframe Monitoring pattern is not configured.

Table 8.8.6.1-2: Minimum performance for EPDCCH for enhanced downlink control channel performance requirements Type A

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55-1 FDD	OP.7 FDD	EVA70	2 x 2 Low	1	15.9

8.9 Demodulation (single receiver antenna)

The SNR deifintion is given in Clause 8.1.1 where the number of receiver antennas N_{RX} assumed for the minimum performance requirement in this clause is 1.

8.9.1 PDSCH

8.9.1.1 FDD and half-duplex FDD (Fixed Reference Channel)

The parameters specified in Table 8.9.1.1-1 are valid for FDD and half-duplex FDD tests unless otherwise stated.

Table 8.9.1.1-1: Common Test Parameters (FDD and half-duplex FDD)

Parameter	Unit	Value
Inter-TTI Distance		1
Number of HARQ		
processes per	Processes	8
component carrier		
Maximum number of		4
HARQ transmission		'
Redundancy version		{0,1,2,3} for QPSK and 16QAM
coding sequence		{0,0,1,2} for 64QAM
Number of OFDM		4 for 1.4 MHz bandwidth, 3 for 3 MHz and
symbols for PDCCH per	OFDM symbols	5 MHz bandwidths,
component carrier	OFDIVI SYTTIDOIS	2 for 10 MHz, 15 MHz and 20 MHz
component carrier		bandwidths
Cyclic Prefix		Normal
Precoder update		Frequency domain: 1 PRG
granularity		Time domain: 1 ms for Transmission
granulanty		mode 9

8.9.1.1.1 Transmit diversity performance (Cell-Specific Reference Symbols)

8.9.1.1.1.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.1.1.1-2, with the addition of the parameters in Table 8.9.1.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.9.1.1.1.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
	σ	dB	0			
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98			
PDSCH transmission	on mode		2			
Note 1: $P_B = 1$.						

Table 8.9.1.1.1.1-2: Minimum performance Transmit Diversity (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference	value	UE DL
number	width and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughp ut (%)	SNR (dB)	category
1	10 MHz 16QAM 1/2	R. 62 FDD	OP.1 FDD	EPA5	2x1 Low	70	9.0	0

8.9.1.1.2 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

8.9.1.1.2.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.1.2.1-2, with the addition of the parameters in Table 8.9.1.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with frequency selective precoding.

Table 8.9.1.1.2.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1	
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	
	σ	dB	0	
$N_{\it oc}$ at antenna	port	dBm/15kHz	-98	
Precoding granul	arity	PRB	6	
PMI delay (Note	2)	ms	8	
Reporting inter	val	ms	8	
Reporting mod	de		PUSCH 1-2	
CodeBookSubsetR	estricti		001111	
on bitmap				
PDSCH transmis	sion		4	
mode				

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.9.1.1.2.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Band-	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE DL
number	width and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	categor y
1	10 MHz 64QAM 1/2	R. 63 FDD	OP.1 FDD	EPA5	2x1Low	70	13.2	0

8.9.1.1.3 Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)

8.9.1.1.3.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.9.1.1.3.1-2 with the addition of the parameters in Table 8.9.1.1.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.9.1.1.3.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Beamforming mo	del		Annex B.4.1
Cell-specific refere	ence		Antenna ports 0,1
CSI reference sign	nals		Antenna ports 15,,18
CSI-RS periodicity and subframe offset $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$		Subframes	5/2
CSI reference sig configuration	CSI reference signal configuration		0
configuration I _{CSI-RS} /	Zero-power CSI-RS configuration I _{CSI-RS} / ZeroPowerCSI-RS		3 / 0001000000000000
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98
Symbols for unus PRBs	Symbols for unused PRBs		OCNG (Note 4)
Number of allocated resource blocks (Note 2)		PRB	6
PDSCH transmiss mode			9
Note 1: D = 1			

Note 1: $P_{R} = 1$.

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.9.1.1.3.1-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE DL
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	category
1	10 MHz QPSK 1/3	R. 64 FDD	OP.1 FDD	EPA5	2x1 Low	70	4.7	0

8.9.1.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.9.1.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.9.1.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value						
Uplink downlink configuration (Note 1)		1						
Special subframe configuration (Note 2)		4						
Cyclic prefix		Normal						
Cell ID		0						
Inter-TTI Distance		1						
Number of HARQ processes per component carrier	Processes	7						
Maximum number of HARQ transmission		4						
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM						
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths						
Precoder update granularity		Frequency domain: 1 PRG Time domain: 1 ms for Transmission mode 9						
ACK/NACK feedback mode		Multiplexing						
Note 1: as specified in Table 4.2-2 in TS 36.211 [4]. Note 2: as specified in Table 4.2-1 in TS 36.211 [4].								

8.9.1.2.1 Transmit diversity performance (Cell-Specific Reference Symbols)

8.9.1.2.1.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.2.1.1-2, with the addition of the parameters in Table 8.9.1.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.9.1.2.1.1-1: Test Parameters for Transmit diversity Performance (FRC)

Parameter		Unit	Test 1-2			
	$ ho_{\scriptscriptstyle A}$	dB	-3			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)			
	σ	dB	0			
N_{oc} at antenna	port	dBm/15kHz	-98			
ACK/NACK feedba	ck mode		Multiplexing			
PDSCH transmission	on mode		2			
Note 1: $P_B = 1$						

Table 8.9.1.2.1.1-2: Minimum performance Transmit Diversity (FRC)

Test	Bandw	Reference	OCNG	Propagation	Correlation	Reference value		UE DL
number	idth	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	category
1	10 MHz 16QAM 1/2	R. 62 TDD	OP.1 TDD	EPA5	2x1 Low	70	8.8	0

8.9.1.2.2 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

8.9.1.2.2.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.9.1.2.2.1-2, with the addition of the parameters in Table 8.9.1.2.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with frequency selective precoding.

Table 8.9.1.2.2.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna po	ort	dBm/15kHz	-98
Precoding granular	ity	PRB	6
PMI delay (Note 2	2)	ms	10 or 11
Reporting interva	l	ms	1 or 4 (Note 3)
Reporting mode			PUSCH 1-2
CodeBookSubsetRest bitmap	riction		001111
ACK/NACK feedback	mode		Multiplexing
PDSCH transmission	mode		4

Note 1: $P_R = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the

eNB downlink before SF#(n+4).

Note 3: For Uplink - downlink configuration 1 the reporting interval will

alternate between 1ms and 4ms.

Table 8.9.1.2.2.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE DL
number		Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	category
1	10 MHz 64QAM 1/2	R. 63 TDD	OP.1 TDD	EPA5	2x1 Low	70	13.1	0

8.9.1.2.3 Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)

8.9.1.2.3.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.9.1.2.3.1-2 with the addition of the parameters in Table 8.9.1.2.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.9.1.2.3.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Parameter		Unit	Test 1
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Cell-specific refere signals	nce		Antenna ports 0,1
CSI reference sign	nals		Antenna ports 15,,18
Beamforming mo	del		Annex B.4.1
CSI-RS periodicity subframe offse $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	t	Subframes	5/4
CSI reference sig configuration	nal		1
Zero-power CSI-l configuration I _{CSI-RS} / ZeroPowerCSI-F bitmap		Subframes / bitmap	4 / 0010000100000000
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98
Symbols for unus PRBs	ed		OCNG (Note 4)
Number of alloca resource blocks (No		PRB	6
Simultaneous transmission			No
PDSCH transmiss mode	sion		9

Note 1: $P_B = 1$.

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.9.1.2.3.1-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE DL
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	category
1	10 MHz QPSK 1/3	R. 64 TDD	OP.1 TDD	EPA5	2x1 Low	70	4.5	0

8.9.2 PHICH

8.9.2.1 FDD and half-duplex FDD

8.9.2.1.1 Transmit diversity performance

For the parameters specified in Table 8.5.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.9.2.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.2.1.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.19	OP.1 FDD	EPA5	2 x 1 Low	0.1	8.6

8.9.2.2 TDD

8.9.2.2.1 Transmit diversity performance

For the parameters specified in Table 8.5.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.9.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.2.2.1-1: Minimum performance PHICH

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.19	OP.1 TDD	EPA5	2 x 1 Low	0.1	8.6

8.9.3 PBCH

8.9.3.1 FDD and half-duplex FDD

8.9.3.1.1 Transmit diversity performance

For the parameters specified in Table 8.6.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.9.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.3.1.1-1: Minimum performance PBCH

Ī	Test	Bandwidth	Reference	Propagation	Antenna	Reference value		
	number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)	
	1	1.4 MHz	R.22	EPA5	2 x 1 Low	1	-1.3	

8.9.3.2 TDD

8.9.3.2.1 Transmit diversity performance

For the parameters specified in Table 8.6.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified value in Table 8.9.3.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.9.3.2.1-1: Minimum performance PBCH

Ī	Test	Bandwidth	Reference	Propagation	Antenna	Reference value		
	number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)	
	1	1.4 MHz	R.22	EPA5	2 x 1 Low	1	-1.7	

8.10 Demodulation (4 receiver antenna ports)

The performance requirements specified in this clause are valid for 4Rx capable UEs.

8.10.1 PDSCH

8.10.1.1 FDD (Fixed Reference Channel)

The parameters specified in Table 8.10.1.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.10.1.1-1: Common Test Parameters (FDD)

Parameter	Unit	Value
Inter-TTI Distance		1
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM
Number of OFDM symbols for PDCCH	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths unless otherwise stated
Precoder update granularity		Frequency domain: 1 PRG for Transmission modes 9 and 10 Time domain: 1 ms
Cyclic Prefix		Normal
Cell_ID		0
Cross carrier scheduling		Not configured

8.10.1.1.1 Transmit diversity performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.1-2, with the addition of the parameters in Table 8.10.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.10.1.1.1-1: Test Parameters for Transmit diversity Performance (FRC) with 4 RX Antenna Ports

Paramete	r	Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{\it oc}$ at antenna port		dBm/15kHz	-98
PDSCH transmission	mode		2
NOTE 1: $P_B = 1$.			

Table 8.10.1.1.1-2: Minimum performance Transmit Diversity (FRC) with 4 RX Antenna Ports

ſ	Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	/alue	UE
	number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
	1	10 MHz 16QAM 1/2	R.11 FDD	OP.1 FDD	EVA5	2x4 Medium correlation A, ULA	70	3.9	≥2

8.10.1.1.1A Transmit diversity performance wit Enhanced Performance Requirement Type A - 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.10.1.1.1A-2, with the addition of parameters in Table 8.10.1.1.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.10.1.1.1A-1, Cell 1 is the serving cell, and Cell 2 is an interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.10.1.1.1A-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

Parameter		Unit	Cell 1	Cell 2
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)	-3
	σ	dB	0	0
Cell-specific reference signa	als		Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port		dBm/15kHz	-98	N/A
DIP (NOTE 2)		dB	N/A	-2.23
BWChannel	MHz	10	10	
Cyclic Prefix		Normal	Normal	
Cell Id			0	1
Number of control OFDM sym	nbols		2	2
PDSCH transmission mod	е		2	N/A
Interference model			N/A	As specified in clause B.5.2
Probability of occurrence of transmission rank in interfering cells	Rank 1	%	N/A	80
	Rank 2		N/A	20
Reporting interval	ms	5	N/A	
Reporting mode		PUCCH 1-0	N/A	
Physical channel for CQI repo		PUSCH(Note 5)	N/A	
cqi-pmi-ConfigurationInde	Х		2	N/A

NOTE 1: $P_{B} = 1$

NOTE 2: The respective received power spectral density of each interfering cell relative to N_{oc} is defined by its associated DIP value as specified in clause B.5.1.

NOTE 3: Cell 1 is the serving cell. Cell 2 is the interfering cell.

NOTE 4: Cell 2 transmission is delayed with respect to Cell 1 by 0.33 ms.

NOTE 5: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5 and #0.

Table 8.10.1.1.1A-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

Test Number	Reference Channel		NG tern		Propagation Correlation Reference Value Matrix and Antenna		Matrix and		
		Cell 1	Cell 2	Cell 1	Cell 2	Configurati on (NOTE 3)	Fraction of Maximum Throughput (%)	SINR (dB) (NOTE 2)	
1	R.46 FDD	OP.1 FDD	N/A	EVA70	EVA70	2x4 Low	70	-4.4	≥1

NOTE 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

NOTE 2: SINR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

NOTE 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

8.10.1.1.2 Open-loop spatial multiplexing performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.2-2, with the addition of the parameters in Table 8.10.1.1.2-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.2-1: Test Parameters for Large Delay CDD (FRC) with 4 RX Antenna Ports

Paramete	er	Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (NOTE 1)
	σ	dB	0
$N_{\it oc}$ at antenna por	t	dBm/15kHz	-98
PDSCH transmission	n mode		3
NOTE 1: $P_B = 1$.			_

Table 8.10.1.1.2-2: Minimum performance Large Delay CDD (FRC) with 4 RX Antenna Ports

	Bandwidt			Brons-	Correlation	Reference value		UE
Test num	h and MCS	Reference channel	OCNG pattern	Propa- gation condi-tion	matrix and antenna config.	Fraction of maximum Throughput (%)	SNR (dB)	cate
1	10 MHz 16QAM 1/2	R.11 FDD	OP.1 FDD	EVA70	2x4 Low	70	8.0	≥2

8.10.1.1.3 Closed-loop spatial multiplexing Enhanced Performance Requirements Type A - Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.3-2, with the addition of the parameters in Table 8.10.1.1.3-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.10.1.1.3-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.10.1.1.3-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model and 4 RX Antenna Ports

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	0
Cell-specific reference si	gnals		Antenna ports 0,1	Antenna ports 0,1
N_{oc} at antenna port		dBm/15kHz	-98	N/A
DIP (Note 2)		dB	N/A	-1.73
BW _{Channel}		MHz	10	10
Cell Id			0	1
PDSCH transmission mo	ode		6	4
Interference model			N/A	As specified in clause B.5.3
Probability of	Rank 1	%	N/A	80
occurrence of transmission rank in interfering cells	ence of hission rank in Rank 2		N/A	20
Precoding granularity		PRB	50	6
PMI delay (Note 4)		ms	8	N/A
Reporting interval		ms	5	N/A
Reporting mode			PUCCH 1-1	N/A
CodeBookSubsetRestric	tion bitmap		1111	N/A

Note 1: $P_{R} = 1$

Note 2: The respective received power spectral density of each interfering cell relative to N_{oc} is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2 is the interfering cell.

Note 4: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 5: All cells are time-synchronous.

Table 8.10.1.1.3-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model and 4 RX Antenna Ports

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions		Correlation Matrix and	Reference \	/alue	UE Cate
	and MCS	Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configuration (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 FDD 16QAM	OP.1 FDD	N/A	EVA5	EVA5	2x4 Low	70	-2.3	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

8.10.1.1.4 Closed-loop spatial multiplexing performance, Dual-Layer Spatial Multiplexing 4 Tx Antenna Port (Cell-Specific Reference Symbols)

For single carrier, the requirements are specified in Table 8.10.1.1.4-2, with the addition of the parameters in Table 8.10.1.1.4-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.4-1: Test Parameters for Dual-Layer Spatial Multiplexing (FRC) with 4 RX Antenna
Ports

Parameter	·	Unit	Test 1-2		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)		
	σ	dB	3		
N_{oc} at antenna port		dBm/15kHz	-98		
Precoding granularity		PRB	6		
PMI delay (Note 2)		ms	8		
Reporting interval		ms	1		
Reporting mode			PUSCH 1-2		
CodeBookSubsetRes	striction		000000000000000000000000000000000000000		
bitmap			00001111111111111111100000000		
			0000000		
PDSCH transmission	mode		4		

Note 1: $P_R = 1$

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 8.10.1.1.4-2: Minimum performance Dual-Layer Spatial Multiplexing (FRC) with 4 RX Antenna Ports

Test num	l h and	Reference channel	OCNG pattern	Propa- gation condi- tion	Correlation matrix and antenna config.	Reference Fraction of maximum throughput (%)	SNR (dB)	UE cate- gory	DL UE categ ory
1	10 MHz	R.36 FDD	OP.1 FDD	EPA5	4x4 Low	70	10.1	≥2	≥6
2	10 MHz 256 QAM	R.72 FDD	OP.1 FDD	EPA5	4x4 Low	70	18.0	11-12	≥11

8.10.1.1.5 Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model (User-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.5-2, with the addition of the parameters in Table 8.10.1.1.5-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.10.1.1.5-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.10.1.1.5-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model and 4 RX Antenna Ports

paramete	parameter		Cell 1	Cell 2	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	0	
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0	
	σ	dB	-3	-3	
Cell-specific referen	ce signals		Antenna ports 0,1	Antenna ports 0,1	
CSI reference signa	ls		Antenna ports 15,16	N/A	
CSI-RS periodicity a subframe offset T _{CS}		Subframes	5/2	N/A	
CSI reference signal configuration			0	N/A	
N_{oc} at antenna port	t	dBm/15kH z	-98	N/A	
DIP (Note 2)		dB	N/A	-1.73	
BWchannel		MHz	10	10	
Cell Id			0	126	
PDSCH transmissio	n mode		9	9	
Beamforming mode	Beamforming model		As specified in clause B.4.3 (Note 4, 5)	N/A	
Interference model	terference model		N/A	As specified in clause B.5.4	
Probability of occurrence of	Rank 1		N/A	70	
transmission rank in interfering cells	Rank 2		N/A	30	
Precoder update gra	anularity	PRB	50	6	
PMI delay (Note 5)		Ms	8	N/A	
Reporting interval		Ms	5	N/A	
Reporting mode			PUCCH 1-1	N/A	
CodeBookSubsetRe bitmap	estriction		001111	N/A	
Symbols for unused	PRBs		OCNG (Note 6)	N/A	
Simultaneous transmission			No simultaneous transmission on the other antenna port in (7 or 8) used for the input signal under test	N/A	
Physical channel for CQI reporting			PUSCH(Note 8)	N/A	
cqi-pmi-Configura	tionIndex		5	N/A	

Note 1: $P_{B} = 1$

Note 2: The respective received power spectral density of each interfering cell relative to N_{oc} ' is defined by its associated DIP value as specified in clause B.5.1.

Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.

Note 4: The precoder in clause B.4.3 follows UE recommended PMI.

Note 5: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 6: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs

shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 7: All cells are time-synchronous.

Note 8: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report

both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on

PUSCH in uplink subframe SF#8 and #3.

Table 8.10.1.1.5-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model and 4 RX Antenna Ports

Test Number	Reference Channel		OCNG Propagation Pattern Conditions		Correlation Matrix and	Reference Value		UE Categor	
	and MCS	Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on (Note 3)	Fraction of Maximum Throughp ut (%)	SINR (dB) (Note 2)	у
1	R. 76 FDD QPSK	OP.1 FDD	N/A	EVA5	EVA5	2x4 Low	70	-3.0	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

8.10.1.1.5A Single-layer Spatial Multiplexing (User-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.5A-2, with the addition of the parameters in Table 8.10.1.1.5A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 with a simultaneous transmission on the other antenna port in the serving cell, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.10.1.1.5A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Parameter		Unit	Test 1		
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0		
	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)		
	σ	dB	-3		

	Annex B.4.1
	Antenna ports 0,1
	Antenna ports 15,,18
Subframes	5/2
	3
Subframes / bitmap	3 / 000100000000000
dBm/15kHz	-98
	OCNG (Note 4)
PRB	50
	Yes (Note 3, 5)
	9
Subframes	NA
	Subframes / bitmap dBm/15kHz PRB

Note 1: $P_R = 1$.

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not

used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities $\,n_{\rm SCID}\,$ are set to 0 for CDM-multiplexed DM RS with

interfering simultaneous transmission test cases.

Table 8.10.1.1.5A-2: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE			
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category			
1	10 MHz 64QAM 1/2	R.50 FDD	OP.1 FDD	EPA5	2x4 Low	70	15.8	≥2			
Note 1:	The reference										

8.10.1.1.5B Single-layer Spatial Multiplexing (With Enhanced DMRS table configured)

For single-layer transmission on antenna port 7, 8, 11 or 13 upon detection of a PDCCH with DCI format 2C, the requirement is specified in Table 8.10.1.1.5B-2, with the addition of the parameters in Table 8.10.1.1.5B-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of the test is to verify rank-1 performance on antenna port 11 with a simultaneous transmission on the antenna port 7, 8 or 13 with DMRS enhancement table and 4 orthogonal DMRS ports (dmrs-Enhancements-r13 UE-EUTRA-Capability [7]).

Table 8.10.1.1.5B -1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations with Enhanced DMRS table

Parameter		Unit	Test 1				
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)				
	σ	dB	-3				
Beamforming model			Annex B.4.1A				
Cell-specific reference sign	gnals		Antenna ports 0,1				
CSI reference signals	S		Antenna ports 15,,18				
CSI-RS periodicity and sub- offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	oframe	Subframes	5/2				
CSI reference signal configuration			3				
Zero-power CSI-RS configuration IcsI-RS / ZeroPowerCSI-RS bitm		Subframes / bitmap	3 / 0001000000000000				
N_{oc} at antenna port		dBm/15kHz	-98				
Symbols for unused PR	RBs		OCNG (Note 4)				
Number of allocated reso blocks (Note 2)	urce	PRB	50				
Simultaneous transmiss	sion		Yes (Note 3, 5)				
dmrs-Enhancements-r			Enable				
PDSCH transmission m	ode		9				
Note 3: Modulation sym	bols of a	an interference sig	er test are mapped onto antenna port 11. nal are random mapped onto one antenna e upadate granularity for randomized				
mapping antenna port is 1 PRG in frequency domain and 1ms in time domain							

mapping antenna port is 1 PRG in frequency domain and 1ms in time domain.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall

be uncorrelated pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 with OCC =4.

Table 8.10.1.1.5B-2: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations with Enhanced DMRS table

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 64QAM 1/2	R.50 FDD	OP.1 FDD	EPA5	2x4 Low	70	15.8	≥2
Note 1:	The reference of	channel applie	s to both the i	input signal unde	er test and the inte	erfering signal.		

8.10.1.1.6 Dual-Layer Spatial Multiplexing (User-Specific Reference Symbols)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.10.1.1.6-2, with the addition of the parameters in Table 8.10.1.1.6-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

Table 8.10.1.1.6-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations with 4 RX Antenna Ports

Parameter		Unit	Test 1			
Para	ameter	Onit	Cell 1	Cell 2		
	$ ho_{\scriptscriptstyle A}$	dB	0	0		
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0		
power allocation	σ	dB	-3	-3		
allocation	PDSCH_RA	dB	4	NA		
	PDSCH_RB	dB	4	NA		
Cell-specifi signals	c reference		Antenna ports 0 and 1	Antenna ports 0 and 1		
Cell ID			0	126		
CSI referer	nce signals		Antenna ports 15,16	NA		
Beamformi	ng model		Annex B.4.2	NA		
CSI-RS periodicity and subframe offset Tcsi-Rs / ∆csi-Rs		Subframes	5/2	NA		
CSI referer configuration			8	NA		
Zero-powe configuration Icsi-Rs ZeroPower bitmap	r CSI-RS on	Subframes / bitmap	3 / 0010000000000000	NA		
$N_{\it oc}$ at ante	enna port	dBm/15kHz	-98	NA		
\hat{E}_s/N_{oc}			Reference Value in Table 8.10.1.1.6-2	7.25dB		
Symbols for PRBs	r unused		OCNG (Note 2)	NA		
Number of allocated resource blocks (Note 2)		PRB	50	NA		
Simultaneous transmission			No	NA		
PDSCH tra mode	nsmission		9	Blanked		

Note 1: $P_{p} = 1$

Note 2: These physical resource blocks are assigned to an arbitrary number of

virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK

modulated.

Table 8.10.1.1.6-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations and 4 RX Antenna Ports

Test number	Bandwidth and MCS	Reference Channel		NG tern		gation dition	Correlation Matrix and	Reference	Reference value	
namber		Onamici	Cell1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	Categ ory
1	10 MHz 16QAM 1/2	R.51 FDD	OP.1 FDD	N/A	ETU5	ETU5	2x4 Low	70	9.2	≥2

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

Note 3: SNR corresponds to \hat{E}_s/N_{oc} of Cell 1.

8.10.1.1.7 Open-loop spatial multiplexing, 3 Layer Multiplexing with 4 Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.7-2, with the addition of the parameters in Table 8.10.1.1.7-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.7-1: Test parameters for Open Loop spatial multiplexing, 3 Layers with 4 Tx ports and 4 Rx ports

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	0
Cell-specific reference			Antenna
			ports
signals			0,1,2,3
$N_{\it oc}$ at antenna port		dBm/15k Hz	-98
PDSCH transmission m	ode		3
PDSCH rank			3
CodeBookSubsetRestric		0100	
bitmap			
Note 1: $P_B = 1$.			

Table 8.10.1.1.7-2: Minimum performance Open Loop spatial multiplexing, 3 Layers with 4 Tx ports and 4 Rx ports

Test	Test Bandwidth Reference OC		OCNG	Propagation	Correlation	Reference value		UE	
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categor y	
1	10 MHz 64QAM	R.73 FDD	OP.1 FDD	EVA70	4x4 Low	70	15.1	≥5	

8.10.1.1.8 Closed-loop spatial multiplexing performance, 4 Layers spatial multiplexing 4 Tx antennas (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.8-2, with the addition of the parameters in Table 8.10.1.1.8-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.8-1: Test parameters for Closed Loop spatial multiplexing, 4 Layers spatial multiplexing with 4 Tx ports and 4 Rx ports

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna port		dBm/15k Hz	-98
Cell-specific reference sign	gnals		Antenna Ports 0,1,2,3
PDSCH transmission m	ode		4
PDSCH rank			4
Precoding granularity	/	PRB	50
PMI delay		ms	8
Reporting interval		ms	1
Reporting mode			PUSCH 3-1
CodeBookSubsetRestric	tion		0xFFFF000000000000
Note 1: $P_B = 1$.			

Table 8.10.1.1.8-2: Minimum performance for Closed Loop spatial multiplexing, 4 Layers spatial multiplexing with 4 Tx ports and 4 Rx ports

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference va	lue	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categor y
1	10 MHz 16QAM 1/2	R.74 FDD	OP.1 FDD	EPA5	4x4 Low	70	14.9	≥5

8.10.1.1.9 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.1.9-2, with the addition of the parameters in Table 8.10.1.1.9-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.1.9-1: Minimum performance for 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Beamforming model			4 layer precoding based on WB PMI feedback
Cell-specific reference signals			Antenna ports 0,1
CSI reference signals			Antenna ports 15,,18
Beamforming model			Annex B.4.3
CSI-RS periodicity and subframe o $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	ffset	Subframes	5/2
CSI reference signal configuration	n		3
Zero-power CSI-RS configuration Icsi-RS / ZeroPowerCSI-RS bitmap		Subframes / bitmap	3 / 0001000000000000
$N_{\it oc}$ at antenna port		dBm/15kHz	-98
Symbols for unused PRBs			OCNG (Note 3)
Number of allocated resource blo (Note 2)	cks	PRB	50
Simultaneous transmission			No
PDSCH transmission mode			9
Precoding granularity			50
PMI delay			8
Reporting interval			1
Reporting mode			PUSCH 3-1
alternativeCodeBookEnabledFor4T	X-r12		False
CodeBookSubsetRestriction bitm	ар		0xFFFF000000000000

Note 1: $P_B = 1$

Note 2: 50 resource blocks are allocated in sub-frames 1,2,3,4,6,7,8,9 and 41 resource

blocks (RB0-RB20 and RB30-RB49) are allocated in sub-frame 0.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual

UEs with one PDSCH per virtual UE; the data transmitted over the OCNG

PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.10.1.1.9-2: Minimum performance for for 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference va	lue	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categor y
1	10 MHz 16QAM	R.75 FDD	OP.1 FDD	EPA5	4x4 Low	70	18.4	≥5

8.10.1.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.10.1.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.10.1.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value						
Uplink downlink configuration (Note 1)		1						
Special subframe configuration (Note 2)		4						
Cyclic prefix		Normal						
Cell ID		0						
Inter-TTI Distance		1						
Number of HARQ processes per component carrier	Processes	7						
Maximum number of HARQ transmission		4						
Redundancy version coding sequence		{0,1,2,3} for QPSK and 16QAM {0,0,1,2} for 64QAM and 256QAM						
Number of OFDM symbols for PDCCH	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths unless otherwise stated						
Cross carrier scheduling		Not configured						
Precoder update granularity		Frequency domain: 1 PRG for Transmission modes 9 and 10 Time domain: 1 ms						
ACK/NACK feedback mode		Multiplexing						
	Note 1: as specified in Table 4.2-2 in TS 36.211 [4].							

8.10.1.2.1 Transmit diversity performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8. 10.1.2.1-2, with the addition of the parameters in Table 8. 10.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.10.1.2.1-1: Test Parameters for Transmit diversity Performance (FRC) with 4Rx Antenna Ports

Paramete	•	Unit	Test 1
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	-3
	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
N_{oc} at antenna port		dBm/15kHz	-98
PDSCH transmission	mode		2
Note 1: $P_B = 1$			

Table 8.10.1.2.1-2: Minimum performance Transmit Diversity (FRC) with 4Rx Antenna Ports

Test	Bandwidt	Reference	Reference OCNG Propagation		Correlation	Reference va	lue	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna	Fraction of Maximum	SNR (dB)	Category
					Configuration	Throughput (%)		
1	10 MHz 16QAM 1/2	R.11 TDD	OP.1 TDD	EVA5	2x4 Medium correlation A, ULA	70	3.9	≥2

8.10.1.2.1A Transmit diversity performance with Enhanced Performance Requirement Type A – 2 Tx Antenna Ports with TM3 interference model

The requirements are specified in Table 8.10.1.2.1A-2, with the addition of parameters in Table 8.10.1.2.1A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cells applying transmission mode 3 interference model defined in clause B.5.2. In Table 8.10.1.2.1A-1, Cell 1 is the serving cell, and Cell 2, 3 are interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1, Cell 2 and Cell 3, respectively.

Table 8.10.1.2.1A-1: Test Parameters for Transmit diversity Performance (FRC) with TM3 interference model

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	0
Cell-specific reference signals			Antenna ports 0,1	Antenna ports 0,1
$N_{\it oc}$ at antenna po	ort	dBm/15kHz	-98	N/A
DIP (Note 2)	dB	N/A	-1.73	
BWchannel	MHz	10	10	
Cyclic Prefix		Normal	Normal	
Cell Id			0	1
Number of control OFDM	symbols		2	2
PDSCH transmission			2	N/A
Interference mode	el		N/A	As specified in clause B.5.2
Probability of occurrence of	Rank 1	%	N/A	80
transmission rank in interfering cells	Rank 2	%	N/A	20
Reporting interval		ms	5	N/A
Reporting mode			PUCCH 1-0	N/A
ACK/NACK feedback		Multiplexing	N/A	
Physical channel for CQI reporting			PUSCH(Note 5)	N/A
cqi-pmi-Configuration	Index		4	N/A

Note 1: $P_{p} = 1$

Note 2: The respective received power spectral density of each interfering cell relative to N_{oc} is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2 is the interfering cell.

Note 4: The cells are time-synchronous.

Note 5: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Table 8.10.1.2.1A-2: Enhanced Performance Requirement Type A, Transmit Diversity (FRC) with TM3 interference model

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions		Correlation Matrix and Antenna	Reference	Value	UE Categ ory
		Cell 1	Cell 2	Cell 1	Cell 2	Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	
1	R.46 TDD	OP.1 TDD	N/A	EVA70	EVA70	2x4 Low	70	-4.9	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{ac} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

8.10.1.2.2 Open-loop spatial multiplexing performance with 2Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.2-2, with the addition of the parameters in Table 8.10.1.2.2-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.2-1: Test Parameters for Large Delay CDD (FRC) with 4Rx Antenna Ports

Paramete	er	Unit	Test 1
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	-3
	$\rho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
	σ	dB	0
N_{oc} at antenna port		dBm/15kHz	-98
ACK/NACK feedback	ck mode		Bundling
PDSCH transmission	n mode		3
Note 1: $P_B = 1$			_

Table 8.10.1.2.2-2: Minimum performance Large Delay CDD (FRC) with 4Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagatio	Correlation	Reference value		UE
num ber	and MCS	Channel	Pattern	n Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Cate gory
1	10 MHz 16QAM 1/2	R.11-1 TDD	OP.1 TDD	EVA70	2x4 Low	70	7.7	≥2

8.10.1.2.3 Closed-loop spatial multiplexing Enhanced Performance Requirements Type A - Single-Layer Spatial Multiplexing 2 Tx Antenna Port with TM4 interference model (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.3-2, with the addition of the parameters in Table 8.10.1.2.3-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with wideband precoding with two transmit antennas when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 4 interference model defined in clause B.5.3. In Table 8.10.1.2.3-1, Cell 1 is the serving cell, and Cell 2 is the interfering cells. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.10.1.2.3-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC) with TM4 interference model and 4Rx Antenna Ports

Parameter		Unit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3
	σ	dB	0	0
Cell-specific reference signal	s		Antenna ports 0,1	Antenna ports 0,1
$N_{\it oc}$ at antenna port		dBm/15kHz	-98	N/A
DIP (Note 2)		dB	N/A	-1.73
BW _{Channel}		MHz	10	10
Cell Id			0	1
PDSCH transmission mode			6	N/A
Interference model			N/A	As specified in clause B.5.3
Probability of occurrence of	Rank 1	%	N/A	80
transmission rank in interfering cells	Rank 2	%	N/A	20
Precoding granularity		PRB	50	6
PMI delay (Note 4)		ms	10 or 11	N/A
Reporting interval		ms	5	N/A
Reporting mode		PUCCH 1-1	N/A	
CodeBookSubsetRestriction	bitmap		1111	N/A

Note 1: $P_{B} = 1$

Note 2: The respective received power spectral density of each interfering cell relative to N_{oc} is defined by its associated DIP value as specified in clause B.5.1.

Note 3: Cell 1 is the serving cell. Cell 2, 3 are the interfering cells.

Note 4: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 5: All cells are time-synchronous.

Table 8.10.1.2.3-2: Enhanced Performance Requirement Type A, Single-Layer Spatial Multiplexing (FRC) with TM4 interference model and 4Rx Antenna Ports

Test Number	Reference Channel	OCNG Pattern		Propagation Conditions		Correlation Matrix and	Reference Value		UE Cate
	and MCS	Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	gory
1	R.47 TDD 16QAM	OP.1 TDD	N/A	EVA5	EVA5	2x4 Low	70	-1.9	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

8.10.1.2.4 Closed-loop spatial multiplexing performance, Dual-Layer Spatial Multiplexing 4 Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.4-2, with the addition of the parameters in Table 8.10.1.2.4-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.4-1: Test Parameters for Dual-Layer Spatial Multiplexing (FRC) with 4Rx Antenna Ports

	Unit	Test 1-2
$ ho_{\scriptscriptstyle A}$	dB	-6
$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
σ	dB	3
	dBm/15kHz	-98
	PRB	6
	ms	10 or 11
	ms	1 or 4 (Note 3)
		PUSCH 1-2
mode		Bundling
triction		000000000000000000000000000000000000000
bitmap		000011111111111111111100000000
		0000000
mode		4
	$ ho_{\scriptscriptstyle B}$	ρ _A dB ρ _B dB σ dB dBm/15kHz PRB ms ms mode striction

Note 1: $P_{R} = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n

based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Note 3: For Uplink - downlink configuration 1 the reporting interval will alternate

between 1ms and 4ms.

Table 8.10.1.2.4-2: Minimum performance Dual-Layer Spatial Multiplexing (FRC) with 4Rx Antenna Ports

	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference v	value	UE	DL UE
	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categor y	category
1	10 MHz 64 QAM	R.36 TDD	OP.1 TDD	EPA5	4x4 Low	70	10.4	≥2	≥6
2	10 MHz 256QAM	R.72 TDD	OP.1 TDD	EPA5	4x4 Low	70	17.5	11-12	≥11

8.10.1.2.5 Enhanced Performance Requirement Type A – Single-layer Spatial Multiplexing with TM9 interference model (User-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.5-2, with the addition of the parameters in Table 8.10.1.2.5-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed-loop rank one performance on one of the antenna ports 7 or 8 without a simultaneous transmission on the other antenna port in the serving cell when the PDSCH transmission in the serving cell is interfered by PDSCH of one dominant interfering cell applying transmission mode 9 interference model defined in clause B.5.4. In 8.10.1.2.5-1, Cell 1 is the serving cell, and Cell 2 is the interfering cell. The downlink physical channel setup is according to Annex C.3.2 for each of Cell 1 and Cell 2, respectively.

Table 8.10.1.2.5-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with TM9 interference model and 4Rx Antenna Ports

paramete	r	Unit	Cell 1	Cell 2
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink power allocation	$\rho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
	σ	dB	-3	-3
Cell-specific referen	ce signals		Antenna ports 0,1	Antenna ports 0,1
CSI reference signa			Antenna ports 15,16	N/A
CSI-RS periodicity a subframe offset Tcs	i-rs / Δ csi-rs	Subframes	5 / 4	N/A
CSI reference signal configuration	ıl		0	N/A
$N_{\it oc}$ at antenna por	t	dBm/15kH z	-98	N/A
DIP (Note 2)		dB	N/A	-1.73
BWchannel		MHz	10	10
Cell Id			0	126
PDSCH transmission	n mode		9	9
Beamforming mode	l		As specified in clause B.4.3 (Note 4, 5)	N/A
Interference model			N/A	As specified in clause B.5.4
Probability of occurrence of	Rank 1		N/A	70
transmission rank in interfering cells	Rank 2		N/A	30
Precoder update gra	anularity	PRB	50	6
PMI delay (Note 5)		ms	10 or 11	N/A
Reporting interval		ms	5	N/A
Reporting mode			PUCCH 1-1	N/A
CodeBookSubsetRe bitmap	estriction		001111	N/A
Symbols for unused	l PRBs		OCNG (Note 6)	N/A
Simultaneous transmission			No simultaneous transmission on the other antenna port in (7 or 8) not used for the input signal under test	N/A
Physical channe reporting			PUSCH(Note 8)	N/A
cqi-pmi-Configura			4	N/A

Note 1: $P_{B} = 1$

Note 2: The respective received power spectral density of each interfering cell relative to N_{ac} is defined by its associated DIP value as specified in clause B.5.1.

Note 3: The modulation symbols of the signal under test in Cell 1 are mapped onto antenna port 7 or 8.

Note 4: The precoder in clause B.4.3 follows UE recommended PMI.

Note 5: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 6: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs

shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 7: All cells are time-synchronous.

Note 8: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report

both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on

PUSCH in uplink subframe SF#8 and #3.

Table 8.10.1.2.5-2: Enhanced Performance Requirement Type A, CDM-multiplexed DM RS with TM9 interference model and 4Rx Antenna Ports

Test Number	Reference Channel	OCNG Pattern			gation itions	Correlation Matrix and	Reference	Value	UE Categ
	and MCS	Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on (Note 3)	Fraction of Maximum Throughput (%)	SINR (dB) (Note 2)	ory
1	R.76 TDD QPSK	OP.1 TDD	N/A	EVA5	EVA5	2x4 Low	70	-3.3	≥1

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Note 3: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

8.10.1.2.5A Single-layer Spatial Multiplexing (with multiple CSI-RS configurations)

The requirements are specified in Table 8.10.1.2.5A-2, with the addition of the parameters in Table 8.10.1.2.5A-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify closed loop rank one performance on one of the antenna ports 7 or 8 with a simultaneous transmission on the other antenna port in the serving cell, and to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power.

Table 8.10.1.2.5A-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with multiple CSI-RS configurations

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3

Cell-specific reference signals		Antenna ports 0,1
CSI reference signals		Antenna ports 15,,18
Beamforming model		Annex B.4.1
CSI-RS periodicity and subframe offset Tcsi-Rs / \(\Delta\colon\) dcsi-Rs	Subframes	5/4
CSI reference signal configuration		3
Zero-power CSI-RS configuration I _{CSI-RS} / ZeroPowerCSI-RS bitmap	Subframes / bitmap	4 / 001000000000000
$N_{\it oc}$ at antenna port	dBm/15kHz	-98
Symbols for unused PRBs		OCNG (Note 4)
Number of allocated resource blocks (Note 2)	PRB	50
Simultaneous transmission		Yes (Note 3, 5)
PDSCH transmission mode		9
Number of MBSFN subframes	Subframes	NA

Note 1: $P_{R} = 1$.

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: Modulation symbols of an interference signal is mapped onto the antenna port (7 or 8) not

used for the input signal under test.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated

pseudo random data, which is QPSK modulated.

Note 5: The two UEs' scrambling identities $n_{\rm SCID}$ are set to 0 for CDM-multiplexed DM RS with

interfering simultaneous transmission test cases.

Table 8.10.1.2.5A-2: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	alue	UE		
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category		
1	10 MHz 64QAM 1/2	R.44 TDD	OP.1 TDD	EPA5	2x4 Low	70	15.8	≥2		
Note 1:	Note 1: The reference channel applies to both the input signal under test and the interfering signal.									

Table 8.10.1.2.5A-3: Void

8.10.1.2.5B Single-layer Spatial Multiplexing (With Enhanced DMRS table configured)

For single-layer transmission on antenna port 7, 8, 11 or 13 upon detection of a PDCCH with DCI format 2C, the requirement is specified in Table 8.10.1.2.5B -2, with the addition of the parameters in Table 8.10.1.2.5B -1 and the downlink physical channel setup according to Annex C.3.2. The purpose of the test is to verify rank-1 performance on antenna port 11 with a simultaneous transmission on the antenna port 7, 8 or 13 with DMRS enhancement table and 4 orthogonal DMRS ports (dmrs-Enhancements-r13 UE-EUTRA-Capability [7]).

Table 8.10.1.2.5B -1: Test Parameters for Testing CDM-multiplexed DM RS (single layer) with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations with Enhanced **DMRS** table

Parameter		Unit	Test 1			
Downlink novem	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)			
	σ	dB	-3			
Beamforming model			Annex B.4.1A			
Cell-specific reference sig	gnals		Antenna ports 0,1			
CSI reference signals	3		Antenna ports 15,,18			
CSI-RS periodicity and sub- offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	oframe	Subframes	5 / 4			
CSI reference signal configuration			3			
Zero-power CSI-RS configuration ICSI-RS / ZeroPowerCSI-RS bitm		Subframes / bitmap	4 / 00100000000000000			
$N_{\it oc}$ at antenna port		dBm/15kHz	-98			
Symbols for unused PR	RBs		OCNG (Note 4)			
Number of allocated reso blocks (Note 2)	ource	PRB	50			
Simultaneous transmiss	sion		Yes (Note 3, 5)			
dmrs-Enhancements-r	13		Enable			
PDSCH transmission m	ode		9			
Note 1: $P_B = 1$.						
Note 2: The modulation symbols of the signal under test are mapped onto						

The modulation symbols of the signal under test are mapped onto

antenna port 11.

Note 3: Modulation symbols of an interference signal are random mapped onto one antenna port among antenna port 7, 8 and 13. The upadate granularity for randomized mapping antenna port is 1 PRG

in frequency domain and 1ms in time domain.

Note 4: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted

over the OCNG PDSCHs shall be uncorrelated pseudo random data,

which is QPSK modulated.

The two UEs' scrambling identities $\,n_{\rm SCID}\,$ are set to 0 with OCC =4. Note 5:

Table 8.10.1.2.5B-2: Minimum performance for CDM-multiplexed DM RS with interfering simultaneous transmission (FRC) with multiple CSI-RS configurations with Enhanced DMRS table

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference v	/alue	UE
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 64QAM 1/2	R.44 TDD	OP.1 TDD	EPA5	2x4 Low	70	15.8	≥2
Note 1:	The reference	channel applie	s to both the	input signal und	er test and the inte	erfering signal.		

8.10.1.2.6 Dual-Layer Spatial Multiplexing (User-Specific Reference Symbols)

For dual-layer transmission on antenna ports 7 and 8 upon detection of a PDCCH with DCI format 2C, the requirements are specified in Table 8.10.1.2.6-2, with the addition of the parameters in Table 8.10.1.2.6-1 where Cell 1 is the serving cell and Cell 2 is the interfering cell. The downlink physical channel setup is set according to Annex C.3.2. The purpose

of these tests is to verify the rank-2 performance for full RB allocation, to verify rate matching with multiple CSI reference symbol configurations with non-zero and zero transmission power, and to verify that the UE correctly estimate SNR.

Table 8.10.1.2.6-1: Test Parameters for Testing CDM-multiplexed DM RS (dual layer) with multiple CSI-RS configurations and 4Rx Antenna Ports

Parameter		Unit		est 1
Ган	ameter	Onit	Cell 1	Cell 2
	$ ho_{\scriptscriptstyle A}$	dB	0	0
Downlink	$\rho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0
power	σ	dB	-3	-3
allocation	PDSCH_RA	dB	4	NA
	PDSCH_RB	dB	4	NA
Cell-specif signals	ic reference		Antenna ports 0 and 1	Antenna ports 0 and 1
Cell ID			0	126
CSI refere	nce signals		Antenna ports 15,16	NA
Beamform	ing model		Annex B.4.2	NA
subframe of T_{CSI-RS} / Δ_{CSI-RS}	CSI-RS periodicity and subframe offset T _{CSI-RS} / ∆ _{CSI-RS}		5 / 4	NA
CSI reference			8	NA
Zero-powe configuration Icsi-Rs / ZeroPower bitmap	r CSI-RS on	Subframes / bitmap	4 / 00100000000000000	NA
$N_{\it oc}$ at ant	enna port	dBm/15kHz	-98	NA
\hat{E}_s/N_{oc}			Reference Value in Table 8.10.1.2.6-2	7.25dB
Symbols for PRBs			OCNG (Note 2)	NA
Number of resource b	allocated locks (Note 2)	PRB	50	NA
Simultaneo transmissio			No	NA
PDSCH tra mode	ansmission		9	Blanked
Note 1:	D 1			

Note 1: $P_B = 1$

Note 2: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.10.1.2.6-2: Minimum performance for CDM-multiplexed DM RS (FRC) with multiple CSI-RS configurations

Test number	Bandwidth and MCS	Reference Channel		NG tern		gation dition	Correlation Matrix and	Reference va	lue	UE Cate
			Cell 1	Cell 2	Cell 1	Cell 2	Antenna Configurati on	Fraction of Maximum Throughput (%)	SNR (dB)	gory
1	10 MHz 16QAM 1/2	R.51 TDD	OP.1 TDD	N/A	ETU5	ETU5	2x4 Low	70	9.5	≥2

Note 1: The propagation conditions for Cell 1 and Cell 2 are statistically independent.

Note 2: Correlation matrix and antenna configuration parameters apply for each of Cell 1 and Cell 2.

Note 3: SNR corresponds to \hat{E}_s/N_{ac} of Cell 1.

8.10.1.2.7 Open-loop spatial multiplexing, 3 Layer Multiplexing with 4 Tx Antenna Ports (Cell-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.7-2, with the addition of the parameters in Table 8.10.1.2.7-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.7-1: Test parameters for Open Loop spatial multiplexing, 3 Layers with 4 Tx ports and 4 Rx ports

Parame	eter	Unit	
Davidial massa	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna por	t	dBm/15kHz	-98
Cell-specific referer	nce signals		Antenna Ports 0,1,2,3
PDSCH transmission	on mode		3
PDSCH rank			3
CodeBookSubsetR bitmap	estriction		0100
Note 1: $P_{R} = 1$.		<u>. </u>	

Table 8.10.1.2.7-2: Minimum performance Open Loop spatial multiplexing, 3 Layers with 4 Tx ports and 4 Rx ports

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference v	alue	ie UE	
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category	
1	10 MHz 64QAM	R.73 TDD	OP.1 TDD	EVA70	4x4 Low	70	14.9	≥5	

8.10.1.2.8 Closed-loop spatial multiplexing performance, 4 Layers spatial multiplexing 4 Tx antennas

The requirements are specified in Table 8.10.1.2.8-2, with the addition of the parameters in Table 8.10.1.2.8-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.8-1: Test parameters for Closed Loop spatial multiplexing, 4 Layers spatial multiplexing with 4 Tx ports and 4 Rx ports

Parameter		Unit	Test 1
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6 (Note 1)
	σ	dB	0
$N_{\it oc}$ at antenna port		dBm/15k Hz	-98
Cell-specific reference sign	gnals		Antenna ports 0,1,2,3
PDSCH transmission m	ode		4
PDSCH rank			4
Precoding granularity	/	PRB	50
PMI delay		ms	10 or 11
Reporting interval		ms	1 or 4
Reporting mode			PUSCH 3-1
CodeBookSubsetRestric	ction		0xFFFF000000000000
Uplink-Downlink Configur	ation		1
Special subframe configu	ration		4
Note 1: $P_B = 1$.	•		

Table 8.10.1.2.8-2: Minimum performance for Closed Loop spatial multiplexing, 4 Layers spatial multiplexing with 4 Tx ports and 4 Rx ports

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference v	value	UE
number	h and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM 1/2	R.74 TDD	OP.1 TDD	EPA5	4x4 Low	70	14.4	≥5

8.10.1.2.9 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

The requirements are specified in Table 8.10.1.2.9-2, with the addition of the parameters in Table 8.10.1.2.9-1 and the downlink physical channel setup according to Annex C.3.2.

Table 8.10.1.2.9-1: Minimum performance for 4 Layer Spatial Multiplexing (User-Specific Reference Symbols)

Parameter		Unit	Test 1
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)
	σ	dB	-3
Beamforming model			4 layer precoding based on WB PMI feedback
Cell-specific reference signals			Antenna ports 0,1
CSI reference signals			Antenna ports 15,,18
Beamforming model			Annex B.4.3
CSI-RS periodicity and subframe of $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	ffset	Subframes	5/4
CSI reference signal configuration	on		3
Zero-power CSI-RS configuration Icsi-RS / ZeroPowerCSI-RS bitmap	n	Subframes / bitmap	4 / 0010000000000000
$N_{\it oc}$ at antenna port		dBm/15kHz	-98
Symbols for unused PRBs			OCNG (Note 3)
Number of allocated resource blo (Note 2)	cks	PRB	50
Simultaneous transmission			No
PDSCH transmission mode			9
Precoding granularity			50
PMI delay			10 or 11
Reporting interval			1 or 4
Reporting mode			PUSCH 3-1
alternativeCodeBookEnabledFor4T	X-r12		False
CodeBookSubsetRestriction bitm	ар		0xFFFF000000000000

Note 1:

50 resource blocks are allocated in sub-frames 4, 9 and 41 resource blocks Note 2:

(RB0-RB20 and RB30-RB49) are allocated in sub-frame 0,1 and 6.

These physical resource blocks are assigned to an arbitrary number of virtual Note 3:

UEs with one PDSCH per virtual UE; the data transmitted over the OCNG

PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Table 8.10.1.2.9-2: Minimum performance for for 4 Layer Spatial Multiplexing (User-Specific **Reference Symbols)**

Test	Bandwidt	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	h amd MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Category
1	10 MHz 16QAM	R.75 TDD	OP.1 TDD	EPA5	4x4 Low	70	19.0	≥5

8.10.2 PDCCH/PCFICH

8.10.2.1 **FDD**

The parameters specified in Table 8.10.2.1-1 are valid for all FDD tests unless otherwise stated.

Table 8.10.2.1-1: Test Parameters for PDCCH/PCFICH with 4 Rx Antenna Ports

Paramete	Parameter		Single antenna port	Transmit diversity		
Number of PDCCH sy	ymbols	symbols	2	2		
PHICH Ng (Note 1)			1	1		
PHICH duration			Normal	Normal		
Unused RE-s and PR	B-s (Note 2)		OCNG	OCNG		
Cell ID			0	0		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3		
σ	7	dB	0	0		
N_{oc} at antenna port	N_{oc} at antenna port		-98	-98		
Cyclic prefix			Normal	Normal		
Note 1: according to Clause 6.9 in TS 36.211 [4]. Note 2: PDSCH is mapped as OCNG.						

8.10.2.1.1 Single-antenna port performance

For the parameters specified in Table 8.10.2.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.1.1-1: Minimum performance PDCCH/PCFICH with 4Rx Antenna ports

Test number	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration and	Reference value	
						correlation Matrix	Pm- dsg (%)	SNR (dB)
1	10 MHz	8 CCE	R.15 FDD	OP.1 FDD	ETU70	1x4 Low	1	-5.4

8.10.2.1.2 Transmit diversity performance with 2 Tx Antenna Ports

For the parameters specified in Table 8.10.2.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8. 10.2.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.1.2-1: Minimum performance PDCCH/PCFICH with 4 Rx Antenna Ports

Test numbe r	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration and correlation Matrix	Refere valu Pm- dsg (%)	
1	10 MHz	4 CCE	R.16 FDD	OP.1 FDD	EVA70	2 x 4 Low	1	-3.5

8.10.2.1.3 Transmit diversity performance with 4 Tx Antenna Ports

For the parameters specified in Table 8.10.2.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.1.3-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.1.3-1: Minimum performance PDCCH/PCFICH with 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 FDD	OP.1 FDD	EPA5	4 x 4 Medium A Xpol	1	-0.4

8.10.2.2 TDD

Table 8.10.2.2-1: Test Parameters for PDCCH/PCFICH

Paran	neter	Unit	Single antenna port	Transmit diversity
Uplink downlink co (Note 1)	onfiguration		0	0
Special subframe (Note 2)	configuration		4	4
Number of PDCCI	H symbols	symbols	2	2
PHICH Ng (Note 3	3)		1	1
PHICH duration			Normal	Normal
Unused RE-s and	PRB-s (Note 4)		OCNG	OCNG
Cell ID			0	0
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3
	σ	dB	0	0
N_{oc} at antenna po	N_{oc} at antenna port Cyclic prefix		-98	-98
Cyclic prefix			Normal	Normal
ACK/NACK feedb	ack mode		Multiplexing	Multiplexing

Note 1: as specified in Table 4.2-2 in TS 36.211 [4].

Note 2: as specified in Table 4.2-1 in TS 36.211 [4].

Note 3: according to Clause 6.9 in TS 36.211 [4].

Note 4: PDSCH is mapped as OCNG.

8.10.2.2.1 Single-antenna port performance

For the parameters specified in Table 8.10.2.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.2.1-1: Minimum performance PDCCH/PCFICH

Test	Bandwidt	Aggregation	Referenc	OCNG	Propagati	Antenna	Referen	ce value
numbe r	h	level	e Channel	Pattern	on Condition	configuratio n and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	8 CCE	R.15 TDD	OP.1 TDD	ETU70	1x4 Low	1	-4.7

8.10.2.2.2 Transmit diversity performance with 2 Tx Antenna Ports

For the parameters specified in Table 8.10.2.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.2.2-1: Minimum performance PDCCH/PCFICH with 4Rx Antenna ports

Test	Bandwidt	Aggregation	Reference	OCNG	Propagation	Antenna	Referen	ce value
number	h	level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm- dsg (%)	SNR (dB)
1	10 MHz	4 CCE	R.16 TDD	OP.1 TDD	EVA70	2 x 4 Low	1	-3.2

8.10.2.2.3 Transmit diversity performance with 4 Tx Antenna Ports

For the parameters specified in Table 8.10.2.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.2.2.3-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.2.2.3-1: Minimum performance PDCCH/PCFICH with 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	5 MHz	2 CCE	R.17 TDD	OP.1 TDD	EPA5	4 x 4 Medium A Xpol	1	0.0

8.10.3 PHICH

The receiver characteristics of the PHICH are determined by the probability of miss-detecting an ACK for a NACK (Pm-an). It is assumed that there is no bias applied to the detection of ACK and NACK (zero-threshold delection).

8.10.3.1 FDD

The parameters specified in Table 8.10.3.1-1 are valid for all FDD tests with 4Rx unless otherwise stated.

Table 8.10.3.1-1: Test Parameters for PHICH with 4 Rx Antenna Ports

Para	meter	Unit	Single antenna port	Transmit diversity	
Daniel Internation	$ ho_{\scriptscriptstyle A}$	dB	0	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3	
	σ	dB	0	0	
PHICH duration			Normal	Normal	
PHICH Ng (Note	1)		Ng = 1	Ng = 1	
PDCCH Content			UL Grant should be included with the proper information aligned with A.3.6. DL Grant: Note 2		
Unused RE-s and	I PRB-s (Note 2)		OCNG	OCNG	
Cell ID			0	0	
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98	-98	
Cyclic prefix			Normal	Normal	

Note 1: according to Clause 6.9 in TS 36.211 [4].

Note 2: Reference measurement channel R.15 FDD for Single Tx Antenna 8.10.3.1.1, R15-2 FDD for Transmit Diversity with 2Tx Antenna Port 8.10.3.1.2, R17 FDD for Transmit diversity with 4Tx Antenna Port 8.10.3.1.3, according to Table A.3.5.1-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 for the serving cell.

8.10.3.1.1 Single Tx Antenna Port performance

For the parameters specified in Table 8.10.3.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.1.1-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.18	OP.1 FDD	ETU70	1 x 4 Low	0.1	1.6

8.10.3.1.2 Transmit diversity performance with 2 Tx Antenna Ports

For the parameters specified in Table 8.10.3.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.1.2-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	10 MHz	R.19	OP.1 FDD	EVA70	2 x 4 Low	0.1	0.6

8.10.3.1.3 Transmit diversity performance with 4 Tx Antenna Ports

For the parameters specified in Table 8.10.3.1-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8 .10.3.1.3-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.1.3-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	5 MHz	R.20	OP.1 FDD	EPA5	4 x 4 Medium correlation A, Cross polarized	0.1	0.1

8.10.3.2 TDD

The parameters specified in Table 8.10.3.2-1 are valid for all TDD tests with 4 Rx unless otherwise stated.

Table 8.10.3.2-1: Test Parameters for PHICH with 4 Rx Antenna Ports

Para	meter	Unit	Single antenna port	Transmit diversity	
Uplink downlink c	onfiguration (Note		1	1	
Special subframe (Note 2)	configuration		4	4	
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0	-3	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0	-3	
	σ	dB	0	0	
PHICH duration			Normal	Normal	
PHICH Ng (Note	1)		Ng = 1	Ng = 1	
PDCCH Content			UL Grant should be included with the proper information aligned with A.3.6. DL Grant: Note 4		
Unused RE-s and	I PRB-s (Note 4)		OCNG	OCNG	
Cell ID	<u> </u>		0	0	
$N_{\it oc}$ at antenna p	ort	dBm/15kHz	-98	-98	
Cyclic prefix			Normal	Normal	
ACK/NACK feedb	ack mode		Multiplexing	Multiplexing	
Note 1: as spe	cified in Table 4.2-2	in TS 36.211 [4].		

Note 2: as specified in Table 4.2-1 in TS 36.211 [4].

according to Clause 6.9 in TS 36.211 [4]. Note 3:

Reference measurement channel R.15 TDD for Single Tx Antenna 8.10.3.2.1, Note 4: R15-2 TDD for Transmit Diversity with 2Tx Antenna Port 8.10.3.2.2, R17 TDD for Transmit diversity with 4Tx Antenna Port 8.10.3.2.3, according to Table A.3.5.2-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1

for the serving cell.

8.10.3.2.1 Single Tx Antenna Port performance

For the parameters specified in Table 8.10.3.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.2.1-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
					and		
					correlation		
					Matrix		
1	10 MHz	R.18	OP.1 TDD	ETU70	1 x 4 Low	0.1	1.7

8.10.3.2.2 Transmit diversity performance with 2 Tx Antenna Ports

For the parameters specified in Table 8.10.3.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.2.2-1: Minimum performance PHICH with 4 Rx Antenna Ports

Ī	Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
	number		Channel	Pattern	Condition	configuration	Pm-an (%)	SNR (dB)
						and		
						correlation		
						Matrix		
Ī	1	10 MHz	R.19	OP.1 TDD	EVA70	2 x 4 Low	0.1	0.9

8.10.3.2.3 Transmit diversity performance with 4 Tx Antenna Ports

For the parameters specified in Table 8.10.3.2-1 the average probability of a miss-detecting ACK for NACK (Pm-an) shall be below the specified value in Table 8.10.3.2.3-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.3.2.3-1: Minimum performance PHICH with 4 Rx Antenna Ports

Test	Bandwidth	Reference	OCNG	Propagation	Antenna	Referen	ce value
number		Channel	Pattern	Condition	configuration and correlation Matrix	Pm-an (%)	SNR (dB)
1	5 MHz	R.20	OP.1 TDD	EPA5	4 x 4 Medium cotrrelation A, Cross polarized	0.1	0.3

8.10.4 ePDCCH

The receiver characteristics of the EPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg). For the distributed transmission tests in 8.10.4.1, EPDCCH and PCFICH are tested jointly, i.e. a miss detection of PCFICH implies a miss detection of EPDCCH. For other tests, EPDCCH and PCFICH are not tested jointly.

8.10.4.1 Distributed Transmission with 4Rx

8.10.4.1.1 FDD

The parameters specified in Table 8.10.4.1.1-1 are valid for all FDD distributed EPDCCH test with 4Rx unless otherwise stated.

Table 8.10.4.1.1-1: Test Parameters for Distributed EPDCCH with 4Rx

Param	eter	Unit	Value		
Number of PDCCH sy	mbols	symbols	2 (Note 1)		
PHICH duration	PHICH duration				
Unused RE-s and PRI	3-s		OCNG		
Cell ID			0		
	$ ho_{\scriptscriptstyle A}$	dB	-3		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	-3		
allocation	σ	dB	0		
	δ	dB	3		
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98		
Cyclic prefix			Normal		
Subframe Configuration	on		Non-MBSFN		
Precoder Update Gran	ularity	PRB	1		
•		ms	1		
Beamforming Pre-Coo	ler		Annex B.4.4		
Cell Specific Reference			Port 0 and 1		
Number of EPDCCH S	Sets Configured		2 (Note 2)		
Number of PRB per E	PDCCH Set		4 (1 st Set) 8 (2 nd Set)		
EPDCCH Subframe M	lonitoring		NA		
PDSCH TM			TM3		
DCI Format			2A		
Note 1: The starting symbol for EPDCCH is derived from the PCFICH. RRC signalling <i>epdcch-StartSymbol-r11</i> is not configured.					
Note 2: The two sets are distributed EPDCCH sets and non-overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured.					

For the parameters specified in Table 8.10.4.1.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.4.1.1-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.4.1.1-2: Minimum performance Distributed EPDCCH with 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Reference	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55 FDD	OP.7 FDD	EVA5	2 x 4 Low	1	-0.7
2	10 MHZ	16 ECCE	R.56 FDD	OP.7 FDD	EVA70	2 x 4 Low	1	-5.8

8.10.4.1.2 TDD

The parameters specified in Table 8.10.4.1.2-1 are valid for all TDD distributed EPDCCH tests with 4Rx unless otherwise stated.

Table 8.10.4.1.2-1: Test Parameters for Distributed EPDCCH with 4Rx

PDCCH syn ation -s and PRB		symbols	2 (Note 1) Normal		
	-S		Normal		
-s and PRB	-S		Homman		
			OCNG		
	Cell ID				
	$ ho_{\scriptscriptstyle A}$	dB	-3		
power	$ ho_{\scriptscriptstyle B}$	dB	-3		
	σ	dB	0		
	δ	dB	3		
enna port	dBm/15 kHz	-98			
x			Normal		
Configuration		Non-MBSFN			
ndata Grani	PRB	1			
puate Grain	ms	1			
		Annex B.4.4			
		Port 0 and 1			
EPDCCH S	ets Configured		2 (Note 2)		
PRB per EP	DCCH Set		4 (1 st Set) 8 (2 nd Set)		
subframe Mo	onitoring		NA		
			TM3		
t			2A		
			0		
			1 (Note 3)		
PCFICH. RF					
Note 2: The two sets are distributed EPDCCH sets and non- overlapping with PRB = {3, 17, 31, 45} for the first set and PRB = {0, 7, 14, 21, 28, 35, 42, 49} for the second set. EPDCCH is scheduled in the first set for Test 1 and second set for Test 2, respectively. Both sets are always configured. Note 3: Demodulation performance is averaged over normal and					
	pdate Grander Grander Green Grander Gr	enna port x Configuration pdate Granularity ng Pre-Coder c Reference Signal EPDCCH Sets Configured PRB per EPDCCH Set subframe Monitoring t . Configuration al Subframe The starting symbol for EPDCC PCFICH. RRC signalling epdccl configured. The two sets are distributed EPI overlapping with PRB = {3, 17, 3 PRB = {0, 7, 14, 21, 28, 35, 42, 42 EPDCCH is scheduled in the first set for Test 2, respectively. Both	enna port ABM/15 kHz Configuration pdate Granularity ng Pre-Coder C Reference Signal EPDCCH Sets Configured PRB per EPDCCH Set Subframe Monitoring It C Configuration al Subframe The starting symbol for EPDCCH is derived PCFICH. RRC signalling epdcch-StartSymbol configured. The two sets are distributed EPDCCH sets approximately subframe and subframe are starting symbol for EPDCCH is derived PCFICH. RRC signalling epdcch-StartSymbol configured. The two sets are distributed EPDCCH sets approximately subframe are starting symbol for the set of the s		

For the parameters specified in Table 8.10.4.1.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.4.1.2-2. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.4.1.2-2: Minimum performance Distributed EPDCCH with 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referenc	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	4 ECCE	R.55 TDD	OP.7 TDD	EVA5	2 x 4 Low	1	-0.7
2	10 MHZ	16 ECCE	R.56 TDD	OP.7 TDD	EVA70	2 x 4 Low	1	-5.8

8.10.4.2 Localized Transmission with TM9 and 4Rx

8.10.4.2.1 FDD

The parameters specified in Table 8.10.4.2.1-1 are valid for all FDD TM9 localized ePDCCH tests with 4Rx unless otherwise stated.

Table 8.10.4.2.1-1: Test Parameters for Localized EPDCCH with TM9 and 4Rx

Parame	eter	Unit	Value			
Number of PDCCH syr	nbols	symbols	1 (Note 1)			
EPDCCH starting sym	ool	symbols	2 (Note 1)			
PHICH duration			Normal			
Unused RE-s and PRE	Unused RE-s and PRB-s		OCNG			
Cell ID			0			
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	σ	dB	-3			
	δ	dB	0			
N_{oc} at antenna port		dBm/15 kHz	-98			
Cyclic prefix			Normal			
Subframe Configuratio	n		Non-MBSFN			
Precoder Undate Gran	Precoder Update Granularity		1			
•		ms	1			
Beamforming Pre-Cod			Annex B.4.5			
Cell Specific Reference			Port 0 and 1			
CSI-RS Reference Sig			Port 15 and 16			
CSI-RS reference sign configuration	al resource		0			
CSI reference signal su configuration I _{CSI-RS}	ubframe		2			
ZP-CSI-RS configuration	on bitmap		000001000000000			
ZP-CSI-RS subframe of			2			
CSI-RS			2			
Number of EPDCCH S	ets		2 (Note 2)			
EPDCCH Subframe M	onitoring pattern		111111110 111111101 1111111011			
subframePatternConfig	g-r11		1111110111 (Note 3)			
PDSCH TM			TM9			
Note 1: The starting symbol for EPDCCH is signalled with <i>epdcch-StartSymbol-r11</i> . However, CFI is set to 1. Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized						

Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set for all tests.

Note 3: EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search space only in SFs configured by *subframePatternConfig-r11*. Legacy PDCCH is not scheduled.

For the parameters specified in Table 8.10.4.2.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.4.2.1-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.4.2.1-2: Minimum performance Localized EPDCCH with TM9 and 4Rx Antenna ports

	Test	Bandwidth	33 3	Reference	OCNG	Propagation	Antenna	Reference value	
	number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
	1	10 MHz	2 ECCE	R.57 FDD	OP.7 FDD	EVA5	2 x 4 Low	1	6.5
ſ	2	10 MHZ	8 ECCE	R.58 FDD	OP.7 FDD	EVA5	2 x 4 Low	1	-1.5

8.10.4.2.2 TDD

The parameters specified in Table 8.10.4.2.2-1 are valid for all TDD TM9 localized ePDCCH tests unless otherwise stated.

Table 8.10.4.2.2-1: Test Parameters for Localized EPDCCH with TM9 and 4Rx

Paramet	er	Unit	Value
Number of PDCCH sym	bols	symbols	1 (Note 1)
EPDCCH starting symbol	ol	symbols	2 (Note 1)
PHICH duration			Normal
Unused RE-s and PRB-s			OCNG
Cell ID			0
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	σ	dB	-3
	δ	dB	0
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98
Cyclic prefix			Normal
Subframe Configuration			Non-MBSFN
Precoder Update Granularity		PRB	1
·		ms	1
Beamforming Pre-Code			Annex B.4.5
Cell Specific Reference			Port 0 and 1
CSI-RS Reference Sign			Port 15 and 16
CSI-RS reference signa configuration	l resource		0
CSI reference signal sub configuration Icsi-Rs	oframe		0
ZP-CSI-RS configuration	n bitmap		000001000000000
ZP-CSI-RS subframe co	onfiguration IzP-		0
Number of EPDCCH Se	ts		2 (Note 2)
EPDCCH Subframe Monitoring pattern subframePatternConfig-r11			1100011000 1100010000 1100011000 1100001000 1100011000 1000011000 1100011000 (Note 3)
PDSCH TM			TM9
TDD UL/DL Configuration	on		0
TDD Special Subframe			1 (Note 4)

- The starting symbol for EPDCCH is signalled with epdcch-StartSymbol-r11. However, CFI is Note 1: set to 1.
- Note 2: The first set is distributed transmission with PRB = {0, 49} and the second set is localized transmission with PRB = {0, 7, 14, 21, 28, 35, 42, 49}. ePDCCH is scheduled in the second set
- EPDCCH is scheduled in every SF. UE is required to monitor ePDCCH for UE-specific search Note 3: space only in SFs configured by subframePatternConfig-r11. Legacy PDCCH is not scheduled.

Demodulation performance is averaged over normal and special subframe. Note 4:

For the parameters specified in Table 8.10.4.2.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.10.4.2.2-2. EPDCCH subframe monitoring is configured and the subframe monitoring requirement in EPDCCH restricted subframes is statDTX of 99.9%.

The downlink physical setup is in accordance with Annex C.3.2.

Table 8.10.4.2.2-2: Minimum performance Localized EPDCCH with TM9 and 4Rx Antenna ports

Test	Bandwidth	Aggregation	Reference	OCNG	Propagation	Antenna	Referenc	e value
number		level	Channel	Pattern	Condition	configuration and correlation Matrix	Pm-dsg (%)	SNR (dB)
1	10 MHz	2 ECCE	R.57 TDD	OP.7 TDD	EVA5	2 x 4 Low	1	6.0
2	10 MHz	8 ECCE	R.58 TDD	OP.7 TDD	EVA5	2 x 4 Low	1	-2.1

8.11 Demodulation (UE supporting coverage enhancement)

The requirements in this sub-clause are defined based on the simulation results with UE DL Category M1 unless otherwise stated.

The requirements of UE DL Category M1 in this sub-clause are applicable for UE DL Category 1 bis and Category 0.

8.11.1 PDSCH

8.11.1.1 FDD and half-duplex FDD (Fixed Reference Channel)

The parameters specified in Table 8.11.1.1-1 are valid for FDD and half-duplex FDD tests unless otherwise stated.

Table 8.11.1.1-1: Common Test Parameters (FDD and half-duplex FDD)

Parameter	Unit	CE Mode A	CE Mode B
Inter-TTI Distance		1	1
Number of HARQ processes per component carrier	Processes	8	2
Maximum number of HARQ transmission		4	4
Redundancy version coding sequence <i>rv_{idx}</i> (Note 1)		{0, 2, 3, 1} for QPSK and 16QAM	{0,0,0,0,2,2,2,2,3,3,3,3,1,1,1,1,1} for QPSK
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths
Cyclic Prefix		Normal	Normal
Beamforming Precoder for MPDCCH		Annex B.4.4	Annex B.4.4
Precoder update granularity for MPDCCH		Frequency domain: 1 PRB Time domain: identical during the hopping period (interval- FDD for CE Mode A)	Frequency domain: 1 PRB Time domain: identical during the hopping period (interval- FDD for CE Mode B)
BL/CE DL subframe comfiguration (fdd- DownlinkOrTddSubfram eBitmapBR)		1111111111	1111111111
Note 1: rv _{idx} is defined i	n TS 36.213 [6] Table	e 7.1.7.1-2.	

8.11.1.1.1 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

8.11.1.1.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.11.1.1.1.1-2, with the addition of the parameters in Table 8.11.1.1.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with frequency selective precoding.

Table 8.11.1.1.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

Parame	ter	Unit	Test 1			
	$\rho_{\scriptscriptstyle A}$	dB	-3			
Downlink powe		dB	-3 (Note 1)			
allocation	σ	dB	0			
	δ	dB	3			
N_{oc} at antenna	port	dBm/15kHz	-98			
Precoding grant	ularity	PRB	6			
PMI delay (Note		ms	10			
Reporting interv		ms	10			
Reporting mode			PUCCH 1-1			
Physical channe			PUSCH(Note4)			
reporting						
cqi-pmi-Configlr	ndex		12			
CodeBookSubs			001111			
on bitmap						
PDSCH transmi	ission		6			
mode						
Coverage enha	ncement		CE Mode A			
mode			CE Wode A			
OFDM starting s			2			
(startSymbolBR			2			
Maximum numb	er of					
repetitions			1			
(mpdcch-NumR						
Frequency hopp			5			
(mpdcch-pdsch-			Disabled			
HoppingConfig)						
MPDCCH trans	mission	ms	1			
duration	20					
Starting subfram configuration for						
MPDCCH	l		1			
(mpdcch_startS	F UESS)					
Narrowband for						
MPDCCH			1			
(mpdcch_Narro	wband)		·			
Note 1: $P_R =$						
- B		in an available	uplink reporting instance at			
			stimation at a downlink SF			
			orted PMI cannot be			
applie	ed at the el	NB downlink bef	ore SF#(n+4).			
			ncturing shall be			
	idered.	r	Č			
Note 4: To avoid collisions between CQI reports and HARQ-ACK it						
			USCH instead of PUCCH.			
			e transmitted in downlink			
			ultiplex with the HARQ-			
		in uplink subfra				
Note 5: If not	otherwise	stated the value	es in this table refer to			

Table 8.11.1.1.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as

Note 5:

appropriate.

Ī	Test	Bandwid	Reference	OCNG	Propagation	Correlation	Reference	value
	number	th and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)
	1	10MHz 16QAM 1/2	R.79 FDD	OP.2 FDD	EPA5	2x1 Low	70%	8.6

8.11.1.1.2 Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)

8.11.1.2.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a MPDCCH with DCI format 6-1A, the requirements are specified in Table 8.11.1.1.2.1-2 with the addition of the parameters in Table 8.11.1.1.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8.

Table 8.11.1.1.2.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer)

parameter		Unit	Test 1	Test 2	Test 3
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)
allocation	σ	dB	-3	-3	-3
	δ	dB	0	0	0
Beamforming	Beamforming model		Annex B.4.1	Annex B.4.1	Annex B.4.1
Cell-specific refer	ence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
$N_{\it oc}$ at anten	na port	dBm/15kHz	-98 (Note 6)	-98 (Note 6)	-98 (Note 6)
Symbols for unu	sed PRBs		OCNG (Note 3)	OCNG (Note 3)	OCNG (Note 3)
Number of allocat blocks (No		PRB	6	6	6
Simultaneous tra	ansmission		No	No	No
PDSCH transmis			9	9	9
Coverage enhance			CE Mode A	CE Mode A	CE Mode A
	OFDM starting symbol (startSymbolBR)		2	2	2
Maximum number for PDSCH (maxNumRepetitio	pdsch-		16	16	Not configured
PDSCH repetition	on number		8	4	2
Frequency h (mpdcch-pdsch-Ho	opping		Enabled	Enabled	Enabled
Frequency hopp (mpdcch-pdsch-Ho			1	1	1
Frequency hopp (interval-F	DD)	ms	8	2	1
MPDCCH transmis (mPDCCH-Num		ms	8	2	1
MPDCCH repetit	ion number		8	2	1
Number of narrowbands for frequency hopping (mpdcch-pdsch-HoppingNB)			2	2	2
Starting subframe configuration for MPDCCH (mpdcch_startSF_UESS)			4	8	10
Narrowband for MPDCCH (mpdcch_Narrowband)			7	7	7
MPDCCH aggregation level			24	24	24

Note 1: $P_B = 1$.

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 4: For each test, DC subcarrier puncturing shall be considered.

Note 5: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate.

Table 8.11.1.1.2.1-2: Minimum performance for CDM-multiplexed DM RS (FRC)

Test	Bandwidth	Reference	OCNG	Propagation			value	ie UE	
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Catego ry	
1	10MHz QPSK 1/3	R.80 FDD	OP.2 FDD	EPA5	2x1 Low	70	-2.0	M1	
2	10MHz QPSK 1/3	R.80-1 FDD	OP.2 FDD	EPA5	2x2 Low	70	-4.0	≥1	
3	10MHz QPSK 1/3	R.80-2 FDD	OP.2 FDD	EPA5	2x4 Low	70	-4.0	≥1	

8.11.1.1.3 Transmit diversity performance (Cell-Specific Reference Symbols)

8.11.1.3.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.11.1.1.3.1-2, with the addition of the parameters in Table 8.11.1.1.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.11.1.1.3.1-1: Test Parameters for Transmit diversity performance (FRC)

Para	meter	Unit	Test 1 (Note 3)	Test 2 (Note 3)	Test 3 (Note 3)	Test 4 (Note 3)
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	-3
Downlink	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
power allocation	σ	dB	0	0	0	0
	δ	dB	3	3	3	3
N_{oc} at ar	ntenna port	dBm/15kHz	-98	-98	-98	-98
Coverage enha	ancement mode		CE Mode B	CE Mode A	CE Mode B	CE Mode B
PDSCH trans	smission mode		2	2	2	2
OFDM starting s (startSymbolBR)			2	2	2	2
Maximum numb for PDSCH (pd. maxNumRepetii pdsch- maxNumRepetii	er of repetitions sch- tionCEmodeA/		Not configured	Not configured	Not configured	Not configured
PDSCH repetition	on number		64	1	32	16
Frequency hopp (mpdcch-pdsch-			Enabled	Disabled	Enabled	Enabled
Frequency hopp (mpdcch-pdsch-			1	N/A	1	1
Frequency hopp (interval-FDD)	oing interval	ms	16	N/A	8	4
MPDCCH transi (mPDCCH-Num		ms	64	1	32	8
MPDCCH repeti	ition number		64	1	32	8
Number of narro frequency hoppi (mpdcch-pdsch-	ng ·HoppingNB)		4	N/A	4	4
Starting subfram for MPDCCH (mpdcch_startS	F_UESS)		2.5	1	2.5	4
Narrowband for (mpdcch_Narrow			7	0	7	7
MPDCCH aggre			24	8	24	24

Note 1:

Note 2:

For each test, DC subcarrier puncturing shall be considered.
Test 1, test 3 and test 4 are applicable for UE supporting CE Mode B. Test 2 is applicable for UE not supporting CE Note 3: Mode B.

If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as Note 4: appropriate.

Table 8.11.1.3.1-2: Minimum performance Transmit Diversity (FRC)

Test	est Bandwi Referen		OCNG	Propagation	Correlation	Reference	value	UE
number	dth and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughp ut (%)	SNR (dB)	Cate gory
1	10MHz QPSK 1/10	R.81 FDD	OP.2 FDD	ETU1	2x1 Low	70	-13.5	M1
2	10MHz 16QAM 1/2	R.79 FDD	OP.2 FDD	EPA5	2x1 Low	70	9.4	M1
3	10MHz QPSK 1/10	R.81-1 FDD	OP.2 FDD	ETU1	2x2 Low	70	-13.3	≥1
4	10MHz QPSK 1/10	R.81-2 FDD	OP.2 FDD	ETU1	2x4 Low	70	-13.3	≥1

8.11.1.2 TDD (Fixed Reference Channel)

The parameters specified in Table 8.11.1.2-1 are valid for all TDD tests unless otherwise stated.

Table 8.11.1.2-1: Common Test Parameters (TDD)

Parameter	Unit	CE Mode A	CE Mode B
Uplink downlink configuration (Note 1)		1	1
Special subframe configuration (Note 2)		4	4
Cyclic prefix		Normal	Normal
Cell ID		0	0
Inter-TTI Distance		1	1
Number of HARQ processes per component carrier	Processes	7	2
Maximum number of HARQ transmission		4	4
Redundancy version coding sequence <i>rvidx</i> (Note 3)		{0, 2, 3, 1} for QPSK and 16QAM	{0,0,0,0,0,0,0,0,0,0,2,2,2, 2,2,2,2,2,2,2
Number of OFDM symbols for PDCCH per component carrier	OFDM symbols	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths	4 for 1.4 MHz bandwidth, 3 for 3 MHz and 5 MHz bandwidths, 2 for 10 MHz, 15 MHz and 20 MHz bandwidths
ACK/NACK feedback mode		Multiplexing	Multiplexing
Beamforming Precoder for MPDCCH		Annex B.4.4	Annex B.4.4
Precoder update granularity for MPDCCH		Frequency domain: 1 PRB Time domain: identical during the hopping period (interval-TDD for CE Mode A)	Frequency domain: 1 PRB Time domain: identical during the hopping period (interval-TDD for CE Mode B)
BL/CE DL subframe comfiguration (fdd-DownlinkOrTddSubfram eBitmapBR) Note 1: as specified in	Table 4.2-2 in TS 36.	1011110111 211 [4].	1011110111

Note 1: as specified in Table 4.2-2 in TS 36.211 [4]. Note 2: as specified in Table 4.2-1 in TS 36.211 [4].

Note 3: *rv_{idx}* is defined in TS 36.213 [6] Table 7.1.7.1-2

8.11.1.2.1 Closed-loop spatial multiplexing performance (Cell-Specific Reference Symbols)

8.11.1.2.1.1 Minimum Requirement Single-Layer Spatial Multiplexing 2 Tx Antenna Port

The requirements are specified in Table 8.11.1.2.1.1-2, with the addition of the parameters in Table 8.11.1.2.1.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify the closed loop rank-one performance with frequency selective precoding.

Table 8.11.1.2.1.1-1: Test Parameters for Single-Layer Spatial Multiplexing (FRC)

	Unit	Test 1
$ ho_{\scriptscriptstyle A}$	dB	-3
$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)
σ	dB	0
δ	dB	3
port	dBm/15kHz	-98
arity	PRB	6
2)	ms	10 or 11
/al	ms	5
Reporting mode		PUCCH 1-1
cqi-pmi-ConfigIndex		4
estricti		001111
oack		Multiplexing
or CQI		PUSCH (Note 3)
sion		6
ement		CE Mode A
		2
er of		1
n-		Disabled
ssion	ms	1
		'
Starting subframe configuration for MPDCCH (mpdcch_startSF_UESS)		1
or		1
	P _B σ δ port arity 2 2) val le dex estricti back or CQI sion ement mbol R) er of etition) ing n- g)) ssion	ρA dB ρB dB σ dB δ dB port dBm/15kHz arity PRB e2) ms val ms le dex estricti back or CQI sion ement mbol er of etition) eing n- g) ssion me or JESS) or

Note 1: $P_B = 1$.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.

MPDCCH DCI format 6-0A shall be transmitted in downlink

SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Note 4: For each test, DC subcarrier puncturing shall be considered.

Note 5: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate.

Table 8.11.1.2.1.1-2: Minimum performance Single-Layer Spatial Multiplexing (FRC)

	Test number	Bandwid th and MCS	Reference Channel	OCNG Pattern	Propagation Condition	Correlation Matrix and Antenna Configuration	Reference v Fraction of Maximum Throughput (%)	snr (dB)
1		10MHz 16QAM 1/2	R.79 TDD	OP.2 TDD	EPA5	2x1 Low	70%	11.4

8.11.1.2.2 Closed-loop spatial multiplexing performance (User-Specific Reference Symbols)

8.11.1.2.2.1 Single-layer Spatial Multiplexing

For single-layer transmission on antenna ports 7 or 8 upon detection of a PDCCH with DCI format 6-1A, the requirements are specified in Table 8.11.1.2.2.1-2 with the addition of the parameters in Table 8.11.1.2.2.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose of these tests is to verify rank-1 performance on one of the antenna ports 7 or 8.

Table 8.11.1.2.2.1-1: Test Parameters for Testing CDM-multiplexed DM RS (single layer)

Para	meter	Unit	Test 1	Test 2	Test 3
D 11 1	$ ho_{\scriptscriptstyle A}$	dB	0	0	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0 (Note 1)	0 (Note 1)	0 (Note 1)
allocation	σ	dB	-3	-3	-3
	δ	dB	0	0	0
Cell-specific refe	erence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
Beamforming me	odel		Annex B.4.1	Annex B.4.1	Annex B.4.1
N_{oc} at antenna	port	dBm/15kHz	-98	-98	-98
Symbols for unu	sed PRBs		OCNG (Note 3)	OCNG (Note 3)	OCNG (Note 3)
Number of allocated blocks (Note 2)	ated resource	PRB	6	6	6
Simultaneous tra	ansmission		No	No	No
PDSCH transmis	PDSCH transmission mode		9	9	9
	Coverage enhancement mode		CE Mode A	CE Mode A	CE Mode A
(startSymbolBR)	OFDM starting symbol (startSymbolBR)		2	2	2
Maximum numb for PDSCH (pds maxNumRepetit	ch- ionCEmodeA)		Not configured	Not configured	Not configured
Frequency hopp (mpdcch-pdsch-	HoppingConfig)		Enabled	Enabled	Enabled
Frequency hopp (mpdcch-pdsch-			1	1	1
Frequency hopp (interval-TDD)		ms	10	1	1
MPDCCH transr (mPDCCH-Num		ms	8	2	1
MPDCCH repeti			8	2	1
frequency hoppi	Number of narrowbands for frequency hopping (mpdcch-pdsch-HoppingNB)		2	2	2
Starting subfram for MPDCCH (mpdcch_startSI	e configuration =_UESS)		10	20	20
Narrowband for (mpdcch_Narrow	MPDCCH		7	7	7
MPDCCH aggre			24	24	24

Note 1: $P_B = 1$.

Note 2: The modulation symbols of the signal under test are mapped onto antenna port 7 or 8.

Note 3: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated.

Note 4: For each test, DC subcarrier puncturing shall be considered.

Note 5: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate.

Table 8.11.1.2.2.1-2: Minimum performance for CDM-multiplexed DM RS without simultaneous transmission (FRC) with multiple CSI-RS configurations

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Reference	UE	
number	and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughpu t (%)	SNR (dB)	Catego ry
1	10MHz QPSK 1/3	R.80 TDD	OP.2 TDD	EPA5	2x1 Low	70	-2.5	M1
2	10MHz QPSK 1/3	R.80-1 TDD	OP.2 TDD	EPA5	2x2 Low	70	-3.6	≥1
3	10MHz QPSK 1/3	[R.80 TDD]	OP.2 TDD	EPA5	2x4 Low	70	-3.7	≥1

9

8.11.1.2.3 Transmit diversity performance (Cell-Specific Reference Symbols)

8.11.1.2.3.1 Minimum Requirement 2 Tx Antenna Port

The requirements are specified in Table 8.11.1.2.3.1-2, with the addition of the parameters in Table 8.11.1.2.3.1-1 and the downlink physical channel setup according to Annex C.3.2. The purpose is to verify the performance of transmit diversity (SFBC) with 2 transmitter antennas.

Table 8.11.1.2.3.1-1: Test Parameters for Transmit diversity performance (FRC)

Parameter		Unit	Test 1 (Note 3)	Test 2 (Note 3)	Test 3 (Note 3)	Test 4 (Note 3)
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)	-3 (Note 1)
Bowinin power uncoation	σ	dB	0	0	0	0
	δ	dB	3	3	3	3
N_{oc} at antenna port		dBm/15kHz	-98	-98	-98	-98
ACK/NACK feedback mode			Multiplexing	Multiplexing	Multiplexing	Multiplexing
PDSCH transmission mode			2	2	2	2
Coverage enhancement mo	de		CE Mode B	CE Mode A	CE Mode B	CE Mode B
PDSCH transmission mode			2	2	2	2
OFDM starting symbol (start	tSymbolBR)		2	2	2	2
Maximum number of repetiti for PDSCH (pdsch- maxNumRepetitionCEmode maxNumRepetitionCEmode	A/pdsch-		Not configured	Not configured	Not configured	Not configured
PDSCH repetition number			64	1	32	16
Frequency hopping (mpdcch-pdsch-HoppingCo	nfig)		Enabled	Disabled	Enabled	Enabled
Frequency hopping offset (mpdcch-pdsch-HoppingOffs	set)		1	N/A	1	1
Frequency hopping interval (interval-TDD)		ms	20	N/A	20	10
MPDCCH transmission dura (mPDCCH-NumRepetition)	ation	ms	64	1	32	8
MPDCCH repetition number	=		64	1	32	8
Number of narrowbands for hopping (mpdcch-pdsch-Ho			4	N/A	4	4
Starting subframe configura MPDCCH (mpdcch-startSF-UESS)	tion for		8	1	8	10
Narrowband for MPDCCH (mpdcch_Narrowband)			7	0	7	7
MPDCCH aggregation level			24	8	24	24

Note 1: $P_B = 1$.

Note 2:

For each test, DC subcarrier puncturing shall be considered.
Test 1, test 3 and test 4 are applicable for UE supporting CE Mode B. Test 2 is applicable for UE not Note 3: supporting CE Mode B.

If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as Note 4: appropriate.

Table 8.11.1.2.3.1-2: Minimum performance Transmit Diversity (FRC)

Test	Bandw	Reference	OCNG	Propagation	Correlation	Reference value		UE
number	idth and MCS	Channel	Pattern	Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughput (%)	SNR (dB)	Categ ory
1	10MHz QPSK 1/10	R.81 TDD	OP.2 TDD	ETU1	2x1 Low	70	-14.0	M1
2	10MHz 16QAM 1/2	R.79 TDD	OP.2 TDD	EPA5	2x1 Low	70	9.6	M1
3	10MHz QPSK 1/10	R.81-1 TDD	OP.2 TDD	ETU1	2x2 Low	70	-13.3	≥1
4	10MHz QPSK 1/10	R.81-2 TDD	OP.2 TDD	ETU1	2x4 Low	70	-13.3	≥1

8.11.2 MPDCCH

The receiver characteristics of the MPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

8.11.2.1 FDD and half-duplex FDD

Table 8.11.2.1-1: Test Parameters for MPDCCH (Category M1)

Parame	eter	Unit	CE Mode A (Test 1)	CE Mode B (Test 1)
OFDM starting symbol	(startSymbolLC)	symbols	2	2
Unused RE-s and PRE	3-s		OCNG	OCNG
Cell ID			0	0
	$ ho_{\scriptscriptstyle A}$	dB	-3	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	-3	0
allocation	σ	dB	0	-3
	δ	dB	3	0
$N_{\it oc}$ at antenna port		dBm/15 kHz	-98	-98
Cyclic prefix			Normal	Normal
Subframe Configuratio	Subframe Configuration			Non-MBSFN
Dragadar Undata Cranularity		PRB	1	1
Precoder Opdate Gran	Precoder Update Granularity		4(Note 2)	16 (Note 2)
Beamforming Pre-Cod		Annex B.4.4	Annex B.4.4	
Cell Specific Reference		Port 0 and 1	Port 0 and 1	
Number of PRB per MI	Number of PRB per MPDCCH Set		4	2+4
Transmission type			Distributed	Localized
Frequency hopping			Disabled	Enabled
Number of frequency harrowbands	opping		N/A	4
Frequency hopping off	set		N/A	1
Frequency hopping into	erval	ms	N/A	16
Value of G in MPDCCH (mpdcch-startSF-UESS	H start subframe		1.5	1.5
Maximum number of re (mPDCCH-NumRepet)	epetitions		32	64
MPDCCH repetition nu			32	64
MPDCCH narrowband (mpdcch- Narrowband)			1	7
PDSCH TM			TM2	TM2
DCI Format			6-1A	6-1B
fdd-DownlinkOrTddSul	oframeBitmapBR		1111111111	1111111111
Note 1. For each ter				

Note 1: For each test, DC subcarrier puncturing shall be considered.

Note 2: Same precoding matrix is used for a PRB across subframes during the frequency hopping interval.

Note 3: For MPDCCH UE-specific search space the formula for the start subframe k0 is given in TS 36.213 [6] clause 9.1.5.

Note 4: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate.

Table 8.11.2.1-2: Test Parameters for MPDCCH (Category ≥1)

Pa	arameter	Unit	CE Mode A (Test 2)	CE Mode A (Test 3)	CE Mode B (Test 2)	CE Mode B (Test 3)
OFDM starti		symbols	2	2	2	2
	Unused RE-s and PRB-s		OCNG	OCNG	OCNG	OCNG
Cell ID			0	0	0	0
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3	0	0	0
power	$ ho_{\scriptscriptstyle B}$	dB	-3	0	0	0
allocation	σ	dB	0	-3	-3	-3
	δ	dB	3	0	0	0
N_{oc} at anter	nna port	dBm/15kHz	-98	-98	-98	-98
Cyclic prefix			Normal	Normal	Normal	Normal
Subframe Co			Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN
		PRB	1	1	1	1
Precoder Up	date Granularity	ms	4(Note 2)	4(Note 2)	16 (Note 2)	16 (Note 2)
Beamforming Pre-Coder			Annex B.4.4	Annex B.4.4	Annex B.4.4	Annex B.4.4
	Cell Specific Reference Signal		Port 0 and 1			
	Number of PRB per MPDCCH		4	4	2+4	2+4
Transmission	n type		Distributed	Distributed	Localized	Localized
Frequency h			Disabled	Disabled	Enabled	Enabled
	requency hopping		N/A	N/A	4	4
	opping offset		N/A	N/A	1	1
	opping interval	ms	N/A	N/A	8	2
Value of G ir	n MPDCCH start apdcch-startSF-		1.5	1.5	1.5	1.5
Maximum nu repetitions(n NumRepetiti	nPDCCH-		8	2	32	8
MPDCCH re	petition number		8	2	32	8
MPDCCH na (mpdcch-Na			1	1	7	7
PDSCH TM			TM2	TM2	TM2	TM2
DCI Format			6-1A	6-1A	6-1B	6-1B
fdd-	ГddSubframeBitma		1111111111	1111111111	1111111111	1111111111

Note 1: For each test, DC subcarrier puncturing shall be considered.

8.11.2.1.1 CE Mode A

For the parameters specified in Table 8.11.2.1-1 and 8.11.2.1-2 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.11.2.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Note 2: Same precoding matrix is used for a PRB across subframes during the frequency hopping interval.

Note 3: For MPDCCH UE-specific search space the formula for the start subframe k0 is given in TS 36.213 [6] clause 9.1.5.

Note 4: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate.

Table 8.11.2.1.1-1: Minimum performance CE Mode A MPDCCH

Test number	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration	Reference value		UE Category
						and correlation Matrix	Pm- dsg (%)	SNR (dB)	
1	10 MHz	16 ECCE	R.82 FDD	OP.2 FDD	EPA5	2 x 1 Low	1	-4.8	M1
2	10 MHz	16 ECCE	[R.82 FDD]	OP.2 FDD	EPA5	2 x 2 Low	1	-6.5	≥1
3	10 MHz	16 ECCE	[R.82 FDD]	OP.2 FDD	EPA5	2 x 4 Low	1	-6.5	≥1

8.11.2.1.2 CE Mode B

For the parameters specified in Table 8.11.2.1-1 and 8.11.2.1-2 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.11.2.1.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.11.2.1.2-1: Minimum performance CE Mode B MPDCCH

Test number	Bandwidth	Aggregation level	Reference Channel	OCNG Pattern	Propagation Condition	Antenna configuration	Reference value		UE Category
						and correlation Matrix	Pm- dsg (%)	SNR (dB)	
1	10 MHz	24 ECCE	R.83 FDD	OP.2 FDD	ETU1	2 x 1 Low	1	-12.0	M1
2	10 MHz	24 ECCE	R.83 FDD	OP.2 FDD	ETU1	2 x 2 Low	1	-13.2	≥1
3	10 MHz	24 ECCE	R.83 FDD	OP.2 FDD	ETU1	2 x 4 Low	1	-12.8	≥1

8.11.2.2 TDD

Table 8.11.2.2-1: Test Parameters for MPDCCH (Category M1)

Parame	Unit	CE Mode A	CE Mode B		
OFDM starting symbol	(startSymbolLC)	symbols	2	2	
Unused RE-s and PRB	-S		OCNG	OCNG	
Cell ID		0	0		
	$ ho_{\scriptscriptstyle A}$	dB	-3	0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	-3	0	
allocation	σ	dB	0	-3	
	δ	dB	3	0	
$N_{\it oc}$ at antenna port	dBm/15 kHz	-98	-98		
Cyclic prefix			Normal	Normal	
Subframe Configuration	1		Non-MBSFN	Non-MBSFN	
Precoder Update Granu	PRB 1				
Frecoder Opdate Grant	ms	5 (Note 2)	20 (Note 2)		
Beamforming Pre-Code		Annex B.4.4	Annex B.4.4		
Cell Specific Reference			Port 0 and 1	Port 0 and 1	
Number of PRB per MP	DCCH Set		4	2+4	
Transmission type		Distributed	Localized		
Frequency hopping			Disabled	Enabled	
Number of frequency he narrowbands	opping		N/A	4	
Frequency hopping offs	set		N/A	1	
Frequency hopping inte		ms	N/A	20	
Value of G in MPDCCH (mpdcch-startSF-UESS	I start subframe		5	5	
Maximum number of re (mPDCCH-NumRepetit	petitions		16	32	
MPDCCH repetition nul			16	32	
MPDCCH narrowband			1	7	
Narrowband)			<u> </u>	•	
PDSCH TM			TM2	TM2	
DCI Format			6-1A	6-1B	
TDD UL/DL Configurati			0	0	
TDD Special Subframe			1	1	
fdd-DownlinkOrTddSub		1	1000010000	1000010000	

Note 1: For each test, DC subcarrier puncturing shall be considered.

Note 2: Same precoding matrix is used for a PRB across subframes during the frequency hopping interval.

Note 3: The special subframes are not supported by MPDCCH, and are assumed as non- BL/CE DL subframes.

Note 4: For MPDCCH UE-specific search space the formula for the start subframe k0 is given in TS 36.213 [6] clause 9.1.5.

Note 5: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate.

Table 8.11.2.2-2: Test Parameters for MPDCCH (Category ≥1)

Pa	arameter	Unit	CE Mode A (Test 2)	CE Mode A (Test 3)	CE Mode B (Test 2)	CE Mode B (Test 3)
OFDM starti (startSymbo	ILC)	symbols	2	2	2	2
Unused RE-	s and PRB-s		OCNG	OCNG	OCNG	OCNG
Cell ID			0	0	0	0
Downlink	$ ho_{\scriptscriptstyle A}$	-3	-3	-3	0	0
power	$ ho_{\scriptscriptstyle B}$	-3	-3	-3	0	0
allocation	σ	0	0	0	-3	-3
	δ	3	3	3	0	0
N_{oc} at ante	nna port	dBm/15kHz	-98	-98	-98	-98
Cyclic prefix			Normal	Normal	Normal	Normal
Subframe C			Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN
		PRB	1	1	1	1
Precoder Up	odate Granularity	ms	5 (Note 2)	5 (Note 2)	20 (Note 2)	20 (Note 2)
Beamformin	g Pre-Coder		Annex B.4.4	Annex B.4.4	Annex B.4.4	Annex B.4.4
	Reference Signal		Port 0 and 1			
Number of F	PRB per MPDCCH		4	4	2+4	2+4
Transmissio	n type		Distributed	Distributed	Localized	Localized
Frequency h			Disabled	Disabled	Enabled	Enabled
	requency hopping		N/A	N/A	4	4
	nopping offset		N/A	N/A	1	1
	nopping interval	ms	N/A	N/A	5	5
Value of G is	n MPDCCH start		5	5	5	5
Maximum nu repetitions(r. NumRepetit	mPDCCH-		4	2	16	8
MPDCCH re	epetition number		4	2	16	8
MPDCCH na (mpdcch-Na			1	1	7	7
PDSCH TM			TM2	TM2	TM2	TM2
DCI Format			6-1A	6-1A	6-1B	6-1B
fdd-	TddSubframeBitma		1000010000	1000010000	1000010000	1000010000

Note 1: For each test, DC subcarrier puncturing shall be considered.

8.11.2.2.1 CE Mode A

For the parameters specified in Table 8.11.2.2-1 and 8.11.2.2-2 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.11.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Note 2: Same precoding matrix is used for a PRB across subframes during the frequency hopping interval.

Note 3: For MPDCCH UE-specific search space the formula for the start subframe k0 is given in TS 36.213 [6] clause 9.1.5.

Note 4: If not otherwise stated, the values in this table refer to parameters in TS 36.211 [4] or/and TS 36.213 [6] as appropriate.

OCNG Test **Bandwidth** Aggregation Reference **Propagation Antenna** Reference UE Channel Pattern Condition number level configuration value Category Pmand SNR correlation dsg (dB) Matrix (%) 1 10 MHz 16 ECCE R.82 TDD OP.2 EPA5 2 x 1 Low 1 -5.3 M1 TDD 2 10 MHz 16 ECCE R.82 TDD OP.2 EPA5 2 x 2 Low 1 ≥1 12.3] TDD 3 10 MHz 16 ECCE OP.2 EPA5 R.82 TDD 2 x 4 Low 1 ≥1 [-TDD 12.8]

Table 8.11.2.2.1-1: Minimum performance CE Mode A MPDCCH

8.11.2.2.2 CE Mode B

For the parameters specified in Table 8.11.2.2-1 and 8.11.2.2-2 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 8.11.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.2.

Test Bandwidth **OCNG Propagation** Reference UE Aggregation Reference **Antenna** number level Channel **Pattern** Condition configuration value Category and Pm-SNR correlation dsg (dB) **Matrix** (%) 1 10 MHz 24 ECCE R.83 TDD OP.2 ETU1 2 x 1 Low -10.1 M1 TDD 2 OP.2 10 MHz 24 ECCE ETU1 2 x 2 Low 1 [R.83] [TBD] ≥1 TDD1 TDD 3 10 MHz 24 ECCE OP.2 ETU1 2 x 4 Low [TBD] **IR.83** ≥1 TDD] TDD

Table 8.11.2.2.2-1: Minimum performance CE Mode B MPDCCH

8.11.3 PBCH

The receiver characteristics of the PBCH are determined by the probability of miss-detection of the PBCH for single decoding interval (Pm-bch-s) and the probability of miss-detection of the PBCH for multiple decoding intervals (Pm-bch-m), which are defined as

$$Pm - bch - s = 1 - \frac{A_s}{B_s}$$

$$Pm - bch - m = 1 - \frac{A_m}{B_m}$$

The probability of miss-detection of the PBCH for single decoding interval (Pm-bch-s) is calculated under assumption of single PBCH TTI interval decoding. A_s is the number of correctly decoded MIB PDUs and B_s is the number of transmitted MIB PDUs (redundancy versions for the same MIB are not counted separately).

The probability of miss-detection of the PBCH for multiple decoding intervals (Pm-bch-m) is calculated over multiple PBCH TTI intervals under assumption of independent PBCH decoding over these intervals. A_m is the number of PBCH decoding intervals with at least one correctly decoded MIB PDU and B_m is the total number of PBCH decoding intervals. A multiple PBCH decoding interval has 1120 ms duration consisting of continuous PBCH TTIs during the test.

8.11.3.1 FDD and half-duplex FDD

Table 8.11.3.1-1: Test Parameters for PBCH

Parameter		Unit	Transmit diversity
Downlink power	PBCH_RA	dB	-3
allocation	PBCH_RB	dB	-3
N_{oc} at ante	N_{oc} at antenna port		-98
Cyclic p	refix		Normal
Cell	D		0
Repetition of the ph channel (I	•		Enabled
Cyclic p	refix		Normal
Note 1: as specifi	ed in Table 6.6.4-1	in TS 36.211 [4].	

8.11.3.1.1 Transmit diversity performance

For the parameters specified in Table 8.11.3.1-1 and Table 8.11.3.1.1-1, the averaged probability of a miss-detected PBCH (Pm-bch-s and Pm-bch-m) shall be below the specified value in Table 8.11.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.11.3.1.1-1: Minimum performance PBCH

Test numb er	Bandwid th	Referen ce Channel	Propagati on Condition	Antenna configurati on and	onfigurati for single		Referend for multip	
				correlation Matrix	Pm- bch-s (%)	SNR (dB)	Pm- bch-m (%)	SNR (dB)
1	10 MHz	R.22	EPA1	2 x 1 Low	1	-1.9	1	-12.6

8.11.3.2 TDD

Table 8.11.3.2-1: Test Parameters for PBCH

	Par	ameter	Unit	Transmit diversity
Uplink do	wnlink c	configuration (Note 1)		1
Special su	ubframe	configuration (Note 2)		4
Downlink	power	PBCH_RA	dB	-3
allocat	ion	PBCH_RB	dB	-3
	$N_{\it oc}$ at a	antenna port	dBm/15kHz	-98
	Сус	ic prefix		Normal
	С	ell ID		0
Repetiti		physical broadcast el (Note 3)		Enabled
	Сус	ic prefix		Normal
Note 1:	as spec	ified in Table 4.2-2 in T	S 36.211 [4].	
Note 2:	as spec	ified in Table 4.2-1 in TS	S 36.211 [4].	
Note 3:	as spec	ified in Table 6.6.4-2 in	TS 36.211 [4].	

8.11.3.2.1 Transmit diversity performance

For the parameters specified in Table 8.11.3.2-1 and Table 8.11.3.2.1-1, the averaged probability of a miss-detected PBCH (Pm-bch-s and Pm-bch-m) shall be below the specified value in Table 8.11.3.2.1-1. The downlink physical setup is in accordance with Annex C.3.2.

Table 8.11.3.2.1-1: Minimum performance PBCH

1	Test number	Bandwidth	Reference Channel	Propagation Condition					
					and correlation Matrix	Pm-bch- s (%)	SNR (dB)	Pm-bch- m (%)	SNR (dB)
	1	10 MHz	R.22	EPA1	2 x 1 Low	1	-2.8	1	-12.9

8.12 Demodulation of Narrowband IoT

8.12.1 NPDSCH

8.12.1.1 Half-duplex FDD

Table 8.12.1.1-1: Common Test Parameters

Parameter	Unit	Value
Number of HARQ processes per component carrier	Processes	1
Maximum number of HARQ transmission		4
Cyclic Prefix		Normal
eutraControlRegionSize-r13		3 for In-band and N/A for Standalone/Guard-band unless otherwise stated
downlinkBitmap-r13 and dl- Gap-r13		Not configured
dl-GapNonAnchor-r13 and downlinkBitmapNonAnchor- r13		Not configured
Unused REs or RB (Note 1)		OCNG
OCNG pattern		NB.OP.1
Note 1: For in-band mode, the PDCCH_CRS should		mission of LTE signals including

Table 8.12.1.1-2: Test Parameters of related NPDCCH and NPUSCH format 2 configurations

Parameter	Unit	Value
DCI format		DCI format N1
scheduling delay field		_
(I _{Delay})		1
$N_{ m Rep}^{\it AN}$ (ack-NACK-		1
NumRepetitions-r13)		
ACK/NACK resource field		0
Reference channel for NPDCCH		R.NB.3 for one NRS antenna port; R.NB.4 for two NRS antenna ports
$lpha_{\it offset}$ (npdcch-Offset-USS-r13)		0

8.12.1.1.1 Minimum Requirements for In-band

The requirements are specified in Table 8.12.1.1.1-2, with the addition of the parameters in Table 8.12.1.1.1 -1 and the downlink physical channel setup according to Annex C.3.2 and C.3.6. The purpose of these tests is to verify the performance.

Table 8.12.1.1.1-1: Test Parameters for NPDSCH under In-band

Parameter		Unit	Test 1, 2
Develor proves allegation of LTC	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation of LTE signal	$ ho_{\scriptscriptstyle B}$	dB	-3(Note 1)
2 3 4	σ	dB	0
N_{oc} at antenna port	N_{oc1}	dBm/15kHz	-93 (Note 2)
T_{oc} at afficilia port	N_{oc2}	dBm/15kHz	-99 (Note 3)
LTE CRS port number (eutra-NumCl	RS-Ports-r13)		4
NPDCCH repetition numb	per	subframe	8 for Test 1; 16 for Test 2; 128 for Test 3.
$R_{ m max}$ (npdcch-NumRepetition	ns-r13)	subframe	8 for Test 1;16 for Test 2;128 for Test 3.
G (nPDCCH-startSF-USS-	-r13)		4 for Test 1; 2 for Test 2; 1.5 for Test 3

Note 1: $P_B = 1$.

Note 2: This noise is applied to all subframes from the end of the NPDCCH to the end of the

following NPDSCH transmission;

Note 3: This noise is applied to all subframes from the end of the NPDSCH to the end of the

following NPDCCH transmission.

Table 8.12.1.1.1-2: Minimum performance under In-band with 2 NRS ports

						Correlation	Reference	value
Test number	Bandwi dth	Carrier Type	Reference Channel	Repetition number	Propagation Condition	Matrix and Antenna Configuration	Fraction of Maximum Throughp ut (%)	SNR (dB)
1	200kHz	Anchor	R.NB.5 FDD	1	EPA5	2x1 Low	70%	6.9
2	200kHz	Anchor	R.NB.5 FDD	32	EPA5	2x1 Low	70%	-4.8
3	200kHz	Non- anchor	R.NB.5-1 FDD	256	ETU1	2x1 Low	70%	-9.8

8.12.1.1.2 Minimum Requirements for Standalone/Guard-band

The requirements are specified in Table 8.12.1.1.2-2, with the addition of the parameters in Table 8.12.1.1.2 -1 and the downlink physical channel setup according to Annex C.3.6. The purpose of these tests is to verify the performance.

Table 8.12.1.1.2-1: Test Parameters for NPDSCH under Standalone/Guard-band

Parameter	Unit	Test 1, 2	
N at antonna part	N_{oc1}	dBm/15kHz	-93 (Note 1)
N_{oc} at antenna port	N_{oc2}	dBm/15kHz	-99 (Note 2)
NPDCCH repetition num	ber	subframe	32 for Test 1; 256 for Test 2.
$R_{ m max}$ (npdcch-NumRepetitio	ns-r13)	subframe	64 for Test 1; 512 for Test 2.
G (nPDCCH-startSF-USS		1.5	
Note 4. This paise is applied to all a	.lafua sa a a fua sa tha a	and at the NIDDCCII	4-4

Note 1: This noise is applied to all subframes from the end of the NPDCCH to the end of the following NPDSCH transmission;

Note 2: This noise is applied to all subframes from the end of the NPDSCH to the end of the following NPDCCH transmission.

Table 8.12.1.1.2-2: Minimum performance for NPDSCH under Standalone/Guard-band with 1 NRS port

Ī								Reference	value
	Test number	Bandwi dth	Carrier Type	Referenc e Channel	Repetition number	Propagati on condition	Number of NRS ports	Fraction of Maximum Throughput (%)	SNR (dB)
	1	200kHz	Anchor	R.NB.6 FDD	32	EPA5	1	70%	-3.4
	2	200kHz	Non- anchor	R.NB.6-1 FDD	256	ETU1	1	70%	-10.2

8.12.2 NPDCCH

The receiver characteristics of the NPDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

8.12.2.1 Half-duplex FDD

The parameters specified in Table 8.12.2.1-1 and Table 8.12.2.1-2 are valid for all half-duplex FDD tests unless otherwise stated.

Table 8.12.2.1-1: Test Parameters for NPDCCH

Parameter	Unit	Single antenna port	Transmit diversity
Narrowband physical layer Cell ID		0	0
$N_{\it oc}$ at antenna port	dBm/15kHz	-98	-98
Cyclic prefix		Normal	Normal
Number of CRS ports for in-band deployment mode		4	4
NPDCCH starting position (eutraControlRegionSize-r13) (Note 1)		3	3
Maximum number of repetitions $R_{ m max}$ (npdcch-NumRepetitions-r13)		128 for Test 1; 1024 for Test 2.	64 for Test 1; 512 for Test 2.
NPDCCH start subframe <i>G</i> (npdcch-startSF-USS-r13)		2 for test 1, 1.5 for test 2	2 for test 1, 1.5 for test 2
NPDCCH fractional period offset			
of starting subframe $lpha_{\it offset}$		0	0
(npdcch-Offset-USS-r13)			
NB-IoT downlink subframe bitmap for anchor carrier (downlinkBitmap-r13)		Not configured	Not configured
NB-IoT downlink subframe bitmap for non-anchor carrier (downlinkBitmapNonAnchor-r13)		Not configured	Not configured
Downlink gap configuration for anchor carrier (dl-Gap-r13)		Not configured	Not configured
Downlink gap configuration for non-anchor carrier (dl-GapNonAnchor-r13)		Not configured	Not configured
Unused REs or RBs (Note 1)		OCNG	OCNG
OCNG pattern		NB.OP.1	NB.OP.1
Note 1: Applicable only for in-ba	nd deployment m	ode.	

Table 8.12.2.1-2: Test Parameters of related NPDSCH and NPUSCH format 2 configurations

Parameter	Unit	Value
Scheduling delay field		_
(I _{Delay})		0
NPDSCH Repetition number		1
N_{oc} at antenna port for	dBm/15kHz	-98
NPDSCH	dbiii/ Toki iz	30
$N_{ m Rep}^{\it AN}$ (ack-NACK-		1
NumRepetitions-r13)		
ACK/NACK resource field		0
Reference channel for NPDSCH		R.NB.6 and R.NB.6-1 for one NRS antenna port; R.NB.5 and R.NB.5-1 for two NRS antenna ports

8.12.2.1.1 Single-antenna performance

For the parameters specified in Table 8.12.2.1.1-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.12.2.1.1-1. The downlink physical channel setup is in accordance with Annex C.3.6.

Table 8.12.2.1.1-1: Minimum performance NPDCCH

Test	Deployment	ment Repetition	Carrier	Reference	Propagation	Number of	Reference value	
number	mode	number (R)	Type	Channel	Condition	NRS ports	Pm-dsg (%)	SNR (dB)
1	Stand- alone/Guard- band	128	Anchor	R.NB.3 FDD	EPA5	1	1	-4.9
2	Stand- alone/Guard- band	1024	Non-anchor	R.NB.3 FDD	ETU1	1	1	-11.4

8.12.2.1.2 Transmit diversity performance

For the parameters specified in Table 8.12.2.1.2-1 the average probability of a missed downlink scheduling grant (Pmdsg) shall be below the specified value in Table 8.12.2.1.2-1. The downlink physical channel setup is in accordance with Annex C.3.6.

Table 8.12.2.1.2-1: Minimum performance NPDCCH

	Test	Deployment	ployment Repetition	Carrier Referei	Reference	Propagation	Number of	Reference value	
	number	mode	number	Type	Channel	Condition	NRS ports	Pm-dsg	SNR
			(R)					(%)	(dB)
Ī	1	In-band	64	Anchor	R.NB.4	EPA5	2	1	-3.9
					FDD				
	2	In-band	512	Non-anchor	R.NB.4	ETU1	2	1	-10.0
					FDD				

8.12.3 Demodulation of NPBCH

The receiver characteristics of the NPBCH are determined by the probability of miss-detection of the NPBCH (Pmbch), which is defined as

$$Pm - bch = 1 - \frac{A}{B}$$

For the performance with single a NPBCH TTI decoding, A is the number of correctly decoded MIB-NB PDUs and B is the number of transmitted MIB-NB PDUs.

For the performance with multiple NPBCH TTIs decoding, A is the number of 5120ms durations consisting of contiguous NPBCH TTIs where there is at least one correctly decoded MIB-NB PDU, and B is the number of 5120ms durations consisting of contiguous NPBCH TTIs during the test.

8.12.3.1 HD-FDD

Table 8.12.3.1-1: Test Parameters for NPBCH

Parameter		Unit	Single antenna port	Transmit diversity
Downlink power	NPBCH_RA	dB	0	-3
allocation	NPBCH_RB	dB	0	-3
$N_{\it oc}$ at antenna port		dBm/15kHz	-98	-98
Cyclic prefix			Normal	Normal
Cell II)		0	0

8.12.3.1.1 Single-antenna port performance with single NPBCH TTI

For the parameters specified in Table 8.12.3.1-1 the average probability of a miss-detecting NPBCH (Pm-bch) shall be below the specified value in Table 8.12.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.6.

Table 8.12.3.1.1-1: Minimum performance NPBCH

Test	Bandwidth	Reference	Propagation	Antenna	Referen	ce value
number		Channel	Condition	configuration and correlation Matrix	Pm-bch (%)	SNR (dB)
1	200 KHz	R.NB1.1	EPA1	1 x 1	1	-2.0

8.12.3.1.2 Transmit diversity performance

8.12.3.1.2.1 Minimum Requirement 2 Tx Antenna Port with multiple NPBCH TTIs

For the parameters specified in Table 8.12.3.1-1 the average probability of a miss-detected NPBCH (Pm-bch) shall be below the specified value in Table 8.12.3.1.2.1-1. The downlink physical setup is in accordance with Annex C.3.6.

Table 8.12.3.1.2.1-1: Minimum performance NPBCH

I	Test	Bandwidth	Reference	Propagation	Antenna	Reference value	
	number		Channel	Condition	configuration	Pm-bch (%)	SNR (dB)
					and		
					correlation		
l					Matrix		
	1	200 KHz	R.NB1.2	EPA1	2 x 1	1	-11.5

9 Reporting of Channel State Information

9.1 General

This section includes requirements for the reporting of channel state information (CSI). For all test cases in this section, the definition of SNR and SINR are in accordance with the one given in clause 8.1.1.

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For the performance requirements specified in this clause, it is assumed that N_{RX} =2 unless otherwise stated.

Unless otherwise stated, 4-bit CQI Table in Table 7.2.3-1 in TS 36.213 [6], and Modulation and TBS index table in Table 7.1.7.1-1 for PDSCH in TS 36.213 [6] are applied in all the CSI requirements.

9.1.1 Applicability of requirements

9.1.1.1 Applicability of requirements for different channel bandwidths

In Clause 9 the test cases may be defined with different channel bandwidth to verify the same CSI requirement.

Test cases defined for 5MHz channel bandwidth that reference this clause are applicable to UEs that support only Band 31.

9.1.1.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in Clause 9 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL CCs in Table 9.1.1.2-1 and 3 or more DL CCs in Table 9.1.1.2-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 9.1.1.2-1: Applicability and test rules for CA UE CQI tests with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order			
CA tests with 2CCs in Clause 9.6.1.1	Any of one of the supported CA capabilities	Any one of the supported FDD CA configurations	10+10 MHz, 20+20 MHz, 5+5 MHz, 10MHz+5MHz, 15MHz+5MHz			
CA tests with 2CCs in Clause 9.6.1.2	Any of one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination			
Note 1: The applicability and test rules are specified in this table, unless otherwise stated. Note 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is 1. Note 3: A single Uplink CC is configured for all tests						

Table 9.1.1.2-2: Applicability and test rules for CA UE CQI tests with 3 or more DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order			
CA tests with 3 ore more CCs in Clause 9.6.1.1	Any of one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination			
Any of one of the supported CA tests with 3 or more CCs in Clause 9.6.1.2 Any of one of the supported CA capabilities with largest aggregated CA bandwidth combination		Any one of the supported TDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination			
Note 1: The applicability and test rules are specified in this table, unless otherwise stated. Note 2: Number of the supported bandwidth combinations to be tested from each selected						
CA configuration is 1.						
Note 3: A single Uplink CC is configured for all tests						

9.1.1.2A Applicability and test rules for different TDD-FDD CA configurations and bandwidth combination sets

The performance requirement for TDD-FDD CA CQI tests in Clause 9 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined for the tests for 2 DL TDD-FDD CA in Table 9.1.1.2A-1 and for 3 or more DL TDD-FDD CA in Table 9.1.1.2A-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 9.1.1.2A-1: Applicability and test rules for CA UE CQI tests for TDD-FDD CA with 2 DL CCs

Tests	CA capability where the tests apply	CA configuration from the selected CA capbility where the tests apply	CA Bandwidth combination to be tested in priority order
CA tests with 2CCs in Clause 9.6.1.3	Any of one of the supported CA capabilities	Any one of the supported TDD- FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination
CA tests with 2CCs in Clause 9.6.1.4	Any of one of the supported CA capabilities	Any one of the supported TDD- FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination

Note 1: The applicability and test rules are specified in this table, unless otherwise stated.

Note 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is 1.

Note 3: A single Uplink CC is configured for all tests

Table 9.1.1.2A-2: Applicability and test rules for CA UE CQI tests for TDD-FDD CA with 3 or more DL CCs

Tests	CA capability where the tests apply	where the tests selected CA capbility where the				
CA tests with 3CCs in Clause 9.6.1.3	Any of one of the supported CA capabilities	Any one of the supported TDD- FDD CA configurations with FDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination			
CA tests with 3CCs in Clause 9.6.1.4 Any of one of the supported CA capabilities		Any one of the supported TDD- FDD CA configurations with TDD PCell with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination			
Note 1: The applicability and test rules are specified in this table, unless otherwise stated. Note 2: Number of the supported bandwidth combinations to be tested from each selected CA configuration is 1						

Note 3: A single Uplink CC is configured for all tests

9.1.1.3 Test coverage for different number of componenet carriers

For FDD CA tests specified in 9.6.1.1, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD CA tests specified in 9.6.1.2, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

For TDD FDD CA tests specified in 9.6.1.3 and 9.6.1.4, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the TDD FDD CA tests with less than the largest number of CCs supported by the UE.

9.1.1.4 Applicability of performance requirements for 4Rx capable UEs

9.1.1.4.1 Applicability rule and antenna connection for single carrier tests with 2Rx

For 4Rx capable UEs all single carrier tests specified in 9.2 to 9.5 with 2Rx are tested on any of the 2Rx supported RF bands by connecting 2 out of the 4Rx with data source from system simulator, and the other 2 Rx are connected with zero input, depending on UE's declaration and AP configuration. Same requirements specified with 2Rx should be applied.

For 4Rx capable UEs without any 2Rx supported RF bands, all single carrier tests specified in 9.2 to 9.5 with 2Rx are tested on any of the 4Rx supported RF bands by duplicating the fading channel from each Tx antenna and add independent noise for each Rx antenna where applicable. Figure 9.1.1.4.1-1 shows an example of antenna connection for 4Rx UE in any one 4Rx supported RF band to perform a 2Rx performance test with antenna configuration as 2x2 without interference for information. The SNR requirements should be applied with 3 dB less than the number specified with 2Rx, unless there is no SNR requirements specified.

For 4Rx capable UEs without any 2Rx supported RF bands, all single carrier tests specified in 9.3.3 with 2Rx are tested on any of the 4Rx supported RF bands by duplicating the fading channel from each Tx antenna and add independent interference for each Rx antenna.

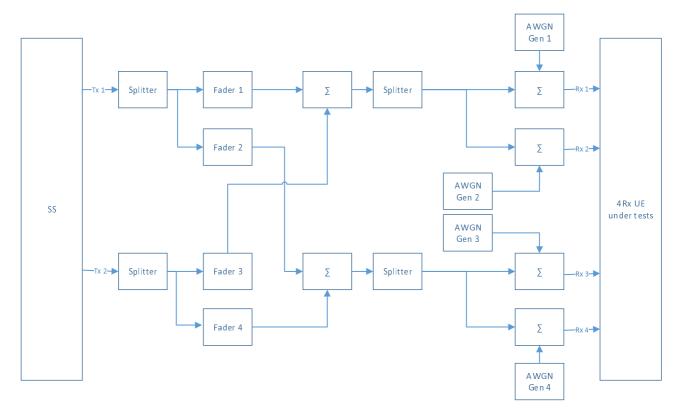


Figure 9.1.1.4.1-1 Antenna connection example for 2Rx tests with antenna configuration as 2x2 without interference (informative)

For 4Rx capable UEs without any 2Rx supported RF bands, for all single carrier tests listed in Table 9.1.1.4.1-1 specified from 9.2 to 9.5 with 2Rx can be skipped.

Table 9.1.1.4.1-1: Requirement lists for 4Rx capable UEs

Requirement lists
Enhanced performance requirements type B
Requirements with demodulation subframe overlaps with aggressor cell ABS
Requirements with demodulation subframe overlaps with aggressor cell ABS and CRS assistance information are
configured

For 4Rx capable UEs, if corresponding tests listed from the 4Rx test lists from Table 9.1.1.4.1-2 are tested, the test coverage can be considered fulfilled without executing the corresponding tests listed from the 2Rx test lists from Table 9.1.1.4.1-2.

9.5.2.2 Test 3

4Rx test lists 2Rx test lists 9.9.1.1.1 Test 1 9.2.1.1 Test 1 9.9.1.1.1 Test 2 9.2.1.1 Test 2 9.9.1.1.2 Test 1 9.2.1.2 Test 1 9.9.1.1.2 Test 2 9.2.1.2 Test 2 9.9.1.2.1 Test 1 9.2.3.1 Test 1 9.9.1.2.1 Test 2 9.9.1.2.2 Test 1 9.2.3.1 Test 2 9.2.3.2 Test 1 9.9.1.2.2 Test 2 9.2.3.2 Test 2 9.9.2.1.1 9.3.5.1.1 9.9.2.1.2 9.3.5.1.2 9.9.2.2.1 9.3.5.2.1 9.9.2.2.2 9.3.5.2.2 9.9.3.1.1 Test 1 9.4.2.3.2 Test 1 9.9.4.1.1 Test 1 9.5.1.1 Test 1 9.9.4.1.1 Test 2 9.5.1.1 Test 2 9.9.4.1.1 Test 3 9.5.1.1 Test 3 9.9.4.1.2 Test 1 9.5.1.2 Test 1 9.9.4.1.2 Test 2 9.5.1.2 Test 2 9.9.4.1.2 Test 3 9.5.1.2 Test 3 9.9.4.2.1 Test 1 9.5.2.1 Test 1 9.9.4.2.1 Test 2 9.5.2.1 Test 2 9.9.4.2.1 Test 3 9.5.2.1 Test 3 9.9.4.2.2 Test 1 9.5.2.2 Test 1 9.9.4.2.2 Test 2 9.5.2.2 Test 2

Table 9.1.1.4.1-2: Applicability rules for single carrier tests with 2Rx

9.1.1.4.2 Applicability rule and antenna connection for CA tests with 2Rx

9.9.4.2.2 Test 3

All tests specified in 9.6 with 2Rx with CA and TDD-FDD CA are tested with 4 Rx capable UEs by connecting all 4Rx with data source from system simulator with the following change on the power level in the test configurations listed in Table 9.1.1.4.2-1 and by scheduling the PDSCH for user data based on the Reference measurement channel RC.1 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 for FDD cells and Reference measurement channel RC.1 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 for TDD cells.

Number of CCs dB[mW/15kHz] 2 **PCell** -88 SCell -95 3,4 **PCell** -85 SCell1 -92 SCell2, SCell3 -99 5 **PCell** -85 SCell1 -92 SCell2, SCell3, SCell4 -99

Table 9.1.1.4.2-1: Power level for 4Rx capable UE to verify CA tests with 2Rx

Within the CA configuration if any of the PCell and/or the SCells is a 2Rx supported RF band, keep the same power level listed in Table 9.1.1.4.2-1. Within the CA configuration if any of the PCell and/or the SCells is a 4Rx supported RF band, configure the power level 3 dB smaller than the number listed in Table 9.1.1.4.2-1. Same requirements specified with 2Rx should be applied.

Same applicability rules defined in 9.1.1.2, 9.1.1.2A for CA and TDD-FDD CA applied for different CA configurations and bandwidth combination sets should be applied for 4 Rx capable UEs.

9.1.1.4.3 Applicability rule and antenna connection for single carrier tests with 4Rx

For 4Rx capable UEs all single carrier tests specified in 9.9 with 4Rx are tested on any of the 4 Rx supported RF bands by connecting all 4Rx with data source from system simulator.

9.1.1.5 Applicability of requirements for UEs supporting coverage enhancement

For 2Rx capable UEs supporting coverage enhancement mode A (ce-ModeA in UE-EUTRA-Capability [7]), all the tests for CE Mode A specified in 9.8 are tested on any of the 2Rx supported RF bands by connecting all 2Rx with data source from system simulator. The SNR requirements should be applied with 3dB less than the number specified with UE DL Category M1.

For 4Rx capable UEs supporting coverage enhancement mode A (ce-ModeA in UE-EUTRA-Capability [7]), all the tests for CE Mode A specified in 9.8 are tested on any of the 4Rx supported RF bands by connecting all 4Rx with data source from system simulator. The SNR requirements should be applied with 6dB less than the number specified with UE DL Category M1.

9.2 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 36.213 [6]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

9.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbols)

9.2.1.1 FDD

The following requirements apply to UE Category ≥ 1 . For the parameters specified in Table 9.2.1.1-1 and Table 9.2.1.1-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 FDD / RC.14 FDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

The applicability of the requirement with 5MHz bandwidth as specificed in Table 9.2.1.1-2 is defined in 9.1.1.1.

Table 9.2.1.1-1: PUCCH 1-0 static test (FDD)

Parameter		Unit	Tes	st 1	Те	st 2
Bandwidth		MHz		10		
PDSCH transmission	n mode				1	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB			0	
allocation	$ ho_{\scriptscriptstyle B}$	dB			0	
	σ	dB			0	
Propagation condit antenna configur			AWGN (1 x 2)			
SNR (Note 2	2)	dB	0	1	6	7
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$		-98	-97	-92	-91
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98	
Max number of H transmission			1			
Physical channel f reporting	PULLE Format /					
PUCCH Report Type			4			
Reporting periodicity		ms	$N_{\rm pd} = 5$			
cqi-pmi-Configurati	onIndex	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			6	

Note 1: Reference measurement channel RC.1 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, except for category 1 UE use RC.4 FDD with two sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.2.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.2.1.1-2: PUCCH 1-0 static test (FDD 5MHz)

Parameter		Unit	Te	st 1	Te	st 2	
Bandwidth		MHz			5		
PDSCH transmission	mode				1		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB			0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB			0		
	σ	dB	0				
Propagation condition antenna configuration				AWG	N (1 x 2)		
SNR (Note 2	2)	dB	[0]	[1]	[6]	[7]	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	[-98]	[-97]	[-97] [-92] [-91]		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-(98	-(98	
Max number of HARO transmissions	2				1		
Physical channel for creporting	CQI		PUCCH Format 2				
PUCCH Report Type			4				
Reporting periodicity		ms	$N_{pd} = 5$				
cqi-pmi-Configuration	Index				6		

Note 1: Reference measurement channel RC.14 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, except for category 1 UE use RC.15 FDD with two sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.2.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

9.2.1.2 TDD

The following requirements apply to UE Category ≥ 1 . For the parameters specified in Table 9.2.1.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 TDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using

the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

Table 9.2.1.2-1: PUCCH 1-0 static test (TDD)

Parameter		Unit	Te	st 1	Te	st 2	
Bandwidth		MHz		,	10		
PDSCH transmission	on mode				1		
Uplink downlink con	figuration				2		
Special subfra configuration					4		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB			0		
allocation	$ ho_{\scriptscriptstyle B}$	dB	0				
	σ	dB			0		
Propagation condit antenna configur				AWG	N (1 x 2)		
SNR (Note 2	2)	dB	0	1	6	7	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	-92	-91	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-(98	-!	98	
Max number of F transmission			1				
Physical channel t reporting	for CQI			PUSCH	I (Note 3)		
PUCCH Report	Туре				4		
Reporting period	dicity	ms		N p	d = 5		
cqi-pmi-ConfigurationIndex 3				3			
ACK/NACK feedba			Multiplexing				
OCNG Pa	ttern OP.1	ent channel RC.1 TI TDD as described in ynamic OCNG Patte	Annex A.5.2	2.1, except for	category 1 Ul	E use RC.4	

- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

9.2.1.3 FDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category ≥ 1 . For the parameters specified in Table 9.2.1.3-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 FDD / RC.6 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets $C_{CSI,1}$ is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets $C_{CSI,1}$ shall be larger than or equal to 2 and less than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Table 9.2.1.3-1: PUCCH 1-0 static test (FDD)

Daramata		l le:4		Tes	t 1		Tes	st 2
Parameter		Unit	Cell 1		Cell 2	Ce	II 1	Cell 2
Bandwidth		MHz	0	10				0
PDSCH transmission		-ID	2		Note 10		2	Note 10
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-3				3
allocation	$ ho_{\scriptscriptstyle B}$	dB		-3				3
Dranagation condi	σ	dB		0			()
Propagation condi- antenna configu	ration		Cla	use B	.1 (2x2)	Clause B		3.1 (2x2)
\widehat{E}_s/N_{oc2} (No	te 1)	dB	4	5	6	4	5	-12
(i)	$N_{oc1}^{(j)}$	dBm/15kHz	-102 (Note	e 7)	N/A	•	ote 7)	N/A
$N_{oc}^{(j)}$ at antenna port	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (Note	e 8)	N/A	•	ote 8)	N/A
ροπ	$N_{oc3}^{(j)}$	dBm/15kHz	-94.8 (Not	e 9)	N/A	-98(N	ote 9)	N/A
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$ dB[mW/15kHz] -94 -93 -92		-94	-93	-110			
Subframe Config	uration		Non-MBS	SFN	Non-MBSFN	Non-N	IBSFN	Non-MBSFN
Cell Id	0-11-		0 5 (1	•) /av.ma.a.b.m	1
Time Offset between	en Cells	μs	2.5 (Sy	ncnro	nous cells) 01010101	2.5	(synchr	onous cells) 01010101
ABS pattern (Note 2)			N/A		01010101 01010101 01010101 01010101	N/A		01010101 01010101 01010101 01010101
RLM/RRM Measu Subframe Pattern			0000010 0000010 0000010 0000010	00 00 00	N/A	00000100 00000100 00000100 00000100 00000100		N/A
CSI Subframe Sets	Ccsi,0		0101010 0101010 0101010 0101010 0101010	01 01 01 01	N/A	0101 0101 0101 0101 0101	0101 0101 0101 0101	N/A
(Note 3)	Ccsi,1		1010101 1010101 1010101 1010101 1010101	10 10 10	N/A	1010 1010 1010	1010 1010 1010 1010 1010	N/A
Number of control symbols	OFDM			3			;	3
Max number of h transmission				1				1
Physical channel for reporting	C _{CSI,0} CQI		PUCCH Format 2		ormat 2	ı	PUCCH	Format 2
	Physical channel for C _{CSI,1} CQI		PUS	1) H38	Note 12)	F	PUSCH	(Note 12)
PUCCH Report				4				4
Reporting perio	ionIndex	Ms	6	N _{pd} =	= 5 N/A		<i>N</i> pd 6	= 5 N/A
C _{CSI,0} (Note 1	3) onIndex2							
C _{CSI,1} (Note 1			5		N/A		5	N/A

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5
- Note 11: Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 for UE Cateogry 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, and RC.6 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP. 1/2 FDD as described in Annex A.5.1.1 and A.5.1.2.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cgi-pmi-ConfigurationIndex is applied for Ccsl.o.
- Note 14: cqi-pmi-ConfigurationIndex2 is applied for Ccsi,1.

9.2.1.4 TDD (CSI measurements in case two CSI subframe sets are configured)

The following requirements apply to UE Category ≥ 1 . For the parameters specified in Table 9.2.1.4-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-1 for Cell 2 and C.3.2-2, the reported CQI value according to RC.2 TDD / RC.6 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets $C_{CSI,1}$ is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1. The value of the median CQI obtained by reports in CSI subframe sets $C_{CSI,0}$ minus the median CQI obtained by reports in CSI subframe sets $C_{CSI,1}$ shall be larger than or equal to 2 and less than or equal to 5 in Test 1 and shall be larger than or equal to 0 and less than or equal to 1 in Test 2.

Table 9.2.1.4-1: PUCCH 1-0 static test (TDD)

Daramatar		Unit		Tes	st 1		Te	st 2
Parameter		Unit	Ce	II 1	Cell 2	Ce	II 1	Cell 2
Bandwidth		MHz		1	0		1	0
PDSCH transmission			2	2	Note 10	2	2	Note 10
Uplink downlink con					1			1
Special subfra configuration				4	4			4
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-:	3		-	3
allocation	$ ho_{\scriptscriptstyle B}$	dB			3			3
	σ	dB		()		(0
Propagation condit antenna configur				Clause E	3.1 (2x2)		Clause I	B.1 (2x2)
\widehat{E}_s/N_{oc2} (Not	e 1)	dB	4	5	6	4		
(1)	$N_{oc1}^{(j)}$	dBm/15kHz	-102 (1	Note 7)	N/A	-98 (N	ote 7)	N/A
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (Note 8)		N/A	-98 (N	lote 8)	N/A
port	$N_{oc3}^{(j)}$	dBm/15kHz	-94.8 (Note 9)		N/A	-98 (N	lote 9)	N/A
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-92	-94	-93	-110
Subframe Configu	uration		Non-M	IBSFN	Non-MBSFN	Non-M	IBSFN	Non-MBSFN
Cell Id			(1	(1
Time Offset between	en Cells	μs	2.5	(synchro	onous cells)	2.5	(synchr	onous cells)
ABS pattern (No	ote 2)		N/A		0100010001 0100010001	N/A		0100010001 0100010001
RLM/RRM Measu	rement		000000001		N/A	000000001		N/A
Subframe Pattern	(Note 4)		00000		IN/A	00000		IN/A
CSI Subframe Sets	Ccsi,0		01000 01000		N/A	01000 01000		N.A
(Note 3)	C _{CSI,1}		10001	01000 01000	N/A	10001 10001		N/A
Number of control	OFDM		10001			10001		2
symbols					3		•	3
Max number of H	HARQ				1		,	1
transmission					1			1
Physical channel for	C _{CSI,0} CQI			PUCCH	Format 2	ı	PUCCH	Format 2
reporting	Casu COL							
Physical channel for C _{CSI,1} CQI reporting			ı	PUSCH ((Note 12)		PUS	SCH
	UCCH Report Type				4			4
	Reporting periodicity ms				= 5			= 5
cqi-pmi-Configurati			3			,	3	
C _{CSI,0} (Note 1	3))	N/A)	N/A
cqi-pmi-Configuration	onIndex2 4)		4	1	N/A	4	1	N/A
ACK/NACK feedba				Multip	lexing		Multip	lexing

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell1 and Cell2 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5
- Note 11: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 for UE Category ≥2 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, and RC.6 TDD according to Table A.4-1 for Category 1 with one/two sided dynami OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1 and Annex A.5.2.2.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cqi-pmi-ConfigurationIndex is applied for Ccsi.o.
- Note 14: cqi-pmi-ConfigurationIndex2 is applied for C_{CSI,1}.

9.2.1.5 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category ≥ 2 . For the parameters specified in Table 9.2.1.5-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C.3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 FDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of ± 1 of the reported median more than 90% of the time.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets $C_{\text{CSI},0}$ is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

For test 2, if the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets $C_{CSI,1}$ is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 2) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.2.1.5-1: PUCCH 1-0 static test (FDD)

Parameter		Unit	Tes	st 1	Tes	st 2
			Cell 1	Cell 2 and 3	Cell 1	Cell 2 and 3
Bandwidth PDSCH transmission		MHz	2	0 Note 10	2	0 Note 10
1 DOCIT (Idiisiilissii		dB	-:			3
Downlink power	ρ_{A}	dB				3
allocation	$ ho_{\scriptscriptstyle B}$ σ	dB)
Propagation condi		uБ				-
antenna configu			Clause E	• •	Clause I	3.1 (2x2)
\widehat{E}_s/N_{oc2} (No	te 1)	dB	4 5	Cell 2: 12 Cell 3: 10	13 14	Cell 2: 12 Cell 3: 10
(i)	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (Note 7)	N/A	-98 (Note 7)	N/A
$N_{oc}^{(j)}$ at antenna port	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (Note 8)	N/A	-98 (Note 8)	N/A
•	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (Note 9)	N/A	-93 (Note 9)	N/A
Subframe Config	uration		Non-MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN
Cell Id			0	Cell 2: 6 Cell 3: 1	0	Cell 2: 6 Cell 3: 1
			Cell 2:		Cell 2:	3 usec
Time Offset between	en Cells	μs	Cell 3:		Cell 3:	-1usec
Frequency Shift betw	veen Cells	Hz	Cell 2: 300Hz		Cell 2: 300Hz	
			Cell 3:		Cell 3:	-100Hz 01010101
ABS pattern (No	ote 2)		N/A	01010101 01010101 01010101 01010101 01010101	N/A	01010101 01010101 01010101 01010101
RLM/RRM Measu Subframe Pattern			00000100 00000100 00000100 00000100 00000100	N/A	00000100 00000100 00000100 00000100 00000100	N/A
CSI Subframe Sets	Ccsi,0		01010101 01010101 01010101 01010101 01010101	N/A	01010101 01010101 01010101 01010101 01010101	N/A
(Note 3)	C _{CSI,1}		10101010 10101010 10101010 10101010 10101010	N/A	10101010 10101010 10101010 10101010 10101010	N/A
Number of control symbols	OFDM		3	3	;	3
Max number of h			1			1
Physical channel for reporting			PUCCH	Format 2	PUCCH	Format 2
Physical channel for C _{CSI,1} CQI reporting			PUSCH (Note 12)	PUSCH	(Note 12)
PUCCH Report			4	•		4
Reporting perio		Ms	$N_{\rm pd}$	= 5	N _{pd}	= 5
cqi-pmi-Configurat Ccsi,0 (Note 1	3)		6	N/A	6	N/A
cqi-pmi-Configuration C _{CSI,1} (Note 1			5	N/A	5	N/A

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 are the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5
- Note 11: Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cqi-pmi-ConfigurationIndex is applied for Ccsl,o.
- Note 14: cqi-pmi-ConfigurationIndex2 is applied for Ccsi,1.

9.2.1.6 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

The following requirements apply to UE Category ≥ 2 . For the parameters specified in Table 9.2.1.6-1, and using the downlink physical channels specified in tables C.3.2-1 for Cell 1, C3.3-2 for Cell 2 and Cell 3, and C.3.2-2, the reported CQI value according to RC.2 TDD in Table A.4-1 in subframes overlapping with aggressor cell ABS and non-ABS subframes shall be in the range of ± 1 of the reported median more than 90% of the time.

For test 1 and test 2, if the PDSCH BLER in ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets $C_{CSI,0}$ is less than or equal to 0.1, the BLER in ABS subframes using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER in ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

For test 2, if the PDSCH BLER in non-ABS subframes using the transport format indicated by median CQI obtained by reports in CSI subframe sets $C_{\text{CSI},1}$ is less than or equal to 0.1, the BLER in non-ABS subframes using the transport format indicated by the (median CQI + 2) shall be greater than 0.1. If the PDSCH BLER in non-ABS subframes using the transport format indicated by the median CQI is greater than 0.1, the BLER in non-ABS subframes using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.2.1.6-1: PUCCH 1-0 static test (TDD)

Davamatar		l lmit		Tes	st 1	Test 2			
Parameter		Unit	Cell	1	Cell 2 and 3	Ce	II 1	Cell 2 and 3	
Bandwidth		MHz		1	0		-	0	
PDSCH transmission			2		Note 10	:	2	Note 10	
Uplink downlink con				1				1	
Special subfra configuration				2	1		4	4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-;	3		-	3	
allocation	$ ho_{\scriptscriptstyle B}$	dB		-:	3		-	3	
	σ	dB		())	
Propagation condition antenna configu			C	Clause E	3.1 (2x2)		Clause I	3.1 (2x2)	
\widehat{E}_s/N_{oc2} (Not	te 1)	dB	4	5	Cell 2: 12 Cell 3: 10	13	14	Cell 2: 12 Cell 3: 10	
(:)	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (No	ote 7)	N/A	-98 (N	lote 7)	N/A	
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (No	-98 (Note 8) N/A		-98 (N	lote 8)	N/A	
port	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (Note 9) N/A		-93 (N	lote 9)	N/A		
Subframe Configu	uration		Non-ME	BSFN	Non-MBSFN	Non-N	1BSFN	Non-MBSFN	
Cell Id			0		Cell 2: 6 Cell 3: 1	0 Cell 2: 6 Cell 3: 1		Cell 2: 6 Cell 3: 1	
Time Offset between	en Cells	μs		Cell 2: Cell 3:		Cell 2: 3 usec Cell 3: -1usec			
Frequency shift betw	een Cells	Hz		Cell 2: Cell 3:	300Hz -100Hz	Cel		2: 300Hz 3: -100Hz	
ABS pattern (No	ote 2)		N/A	A	0100010001 0100010001	N	/A	0100010001 0100010001	
RLM/RRM Measu Subframe Pattern			000000		N/A		00001	N/A	
CSI Subframe Sets	Ccsi,0		010001 010001		N/A)10001)10001	N.A	
(Note 3)	C _{CSI,1}		100010 100010	1000	N/A	10001	01000 01000	N/A	
Number of control symbols	OFDM			3	3		;	3	
Max number of F transmission				1	1		i	1	
Physical channel for reporting			Р	UCCH	Format 2		PUCCH	Format 2	
	sical channel for C _{CSI,1} CQI		Р	USCH ((Note 12)		PUSCH	(Note 12)	
	PUCCH Report Type				1			4	
Reporting periodicity		ms		N _{pd}	= 5		N _{pd}	= 5	
cqi-pmi-Configurati Ccsi,0 (Note 1	ionIndex		3	·	N/A	;	3	N/A	
cqi-pmi-Configuration C _{CSI,1} (Note 1	onIndex2		4		N/A	,	4	N/A	
ACK/NACK feedba				Multip	lexing		Multip	lexing	

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9].
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5
- Note 11: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 12: To avoid collisions between HARQ-ACK and wideband CQI it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 13: cgi-pmi-ConfigurationIndex is applied for C_{CSI,0}.
- Note 14: cqi-pmi-ConfigurationIndex2 is applied for Ccsi,1.

9.2.1.7 FDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

The following requirements apply to UE Category 11-12 and DL Category \geq 11. For the parameters specified in Table 9.2.1.7-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1A FDD in Table A.4-1 shall be in the range of \pm 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Table 9.2.1.7-1: PUCCH 1-0 static test (FDD)

Parameter		Unit	Tes	st 1	Te	st 2	
Bandwidth		MHz			10		
PDSCH transmission	n mode				1		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB			0		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB			0		
	σ	dB	0				
	Propagation condition and antenna configuration			AWG	N (1 x 2)		
SNR (Note 2	2)	dB	-1	0	20	21	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	dB[mW/15kHz] -99 -98 -		-78	-77	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-9	98	
Max number of H transmission					1		
Physical channel f reporting	Physical channel for CQI reporting		PUCCH Format 2				
PUCCH Report	Туре		4				
Reporting period	dicity	ms	$N_{pd} = 5$				
cqi-pmi-Configurati	onIndex				6		

Note 1: Reference measurement channel RC.1A FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

9.2.1.8 TDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

The following requirements apply to UE Category 11-12 and UE DL Category \geq 11. For the parameters specified in Table 9.2.1.8-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1A TDD in Table A.4-1 shall be in the range of \pm 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Parameter		Unit	Tes	st 1	Te	st 2	
Bandwidth		MHz			20		
PDSCH transmission	n mode				1		
Uplink downlink conf	iguration				2		
Special subfra configuration					4		
December to a constant	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0				
	σ	dB	0				
Propagation condit antenna configur			AWGN (1 x 2)				
SNR (Note 2)		dB	-1	0	20	21	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-99	-98	-78	-77	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98			98	
Max number of H transmission					1		
Physical channel f reporting	or CQI			PUSCH	I (Note 3)		
			•		4		
Reporting periodicity		ms	<u> </u>	Np	d = 5		
cqi-pmi-Configurati	onIndex				3		
ACK/NACK feedback	ck mode			Multi	plexing		
PUCCH Report Type Reporting periodicity ms cqi-pmi-ConfigurationIndex ACK/NACK feedback mode			4 N _{pd} = 5				

Table 9.2.1.8-1: PUCCH 1-0 static test (TDD)

- Note 1: Reference measurement channel RC.1A TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

9.2.2 Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

9.2.2.1 FDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.2.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial

differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI_1 = wideband CQI_0 - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Parameter		Unit	Te	st 1	Tes	st 2	
Bandwidth		MHz			10		
PDSCH transmission	on mode				4		
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB			-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB			-3		
	σ	dB			0		
Propagation condit antenna configur	ion and ration			Clause	B.1 (2 x 2)		
CodeBookSubsetRe bitmap	estriction		010000				
SNR (Note 2	2)	dB	10	11	16	17	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-87	-82	-81	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-!	98	-9	98	
Max number of F transmission					1		
Physical channel for reporting	CQI/PMI			PUCCH	Format 2		
PUCCH Report Ty CQI/PMI	ype for		2				
PUCCH Report Typ	e for RI		3				
Reporting period		ms	$N_{pd} = 5$				
cqi-pmi-Configurati					6		
ri-ConfigInde	X			1 (N	lote 3)		

Table 9.2.2.1-1: PUCCH 1-1 static test (FDD)

- Note 1: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: It is intended to have UL collisions between RI reports and HARQ-ACK, since the RI reports shall not be used by the eNB in this test.

9.2.2.2 TDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.2.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI_1 = wideband CQI_0 - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

node	MHz		t Test 1 Test 2				
ode				10			
				4			
ation				2			
				4			
$ ho_{\scriptscriptstyle A}$	dB			-3			
$ ho_{\scriptscriptstyle B}$	dB			-3			
σ	dB	0					
			Clause	B.1 (2 x 2)			
ction			01	0000			
	dB	10	11	16	17		
	dB[mW/15kHz]	-88	-87	-82	-81		
	dB[mW/15kHz]	-9	98	-9	98		
Q				1			
I/PMI			PUSCH	I (Note 3)			
reporting PUCCH Report Type				2			
y	ms	$N_{pd} = 5$					
cqi-pmi-ConfigurationIndex		3					
		805 (Note 4)					
node			Multi	plexing			
	P _B σ and n ction Q I/PMI e y ndex	ρ _A dB ρ _B dB σ dB and dB dand dB dB[mW/15kHz] dB[mW/15kHz] Q I/PMI e y node ms	ρ _A dB ρ _B dB σ dB and n ction dB 10 dB[mW/15kHz] -88 dB[mW/15kHz] -9 Q I/PMI e y ms node node node	ρ _A dB ρ _B dB σ dB and Clause I and 01 dB 10 11 dB[mW/15kHz] -88 -87 dB[mW/15kHz] -98 Q I/PMI PUSCH PUSCH e Pusch Np ordex Multi Multi	A A A A A A A A A A		

Table 9.2.2.2-1: PUCCH 1-1 static test (TDD)

- Note 1: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

9.2.3 Minimum requirement PUCCH 1-1 (CSI Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

9.2.3.1 FDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.3.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median $CQI_1 +1$ } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median $CQI_0 - 1$ and median $CQI_1 - 1$ shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median $CQI_0 + 1$ and median $CQI_1 + 1$ shall be greater than or equal to 0.1.

Table 9.2.3.1-1: PUCCH 1-1 static test (FDD)

Parameter	٢	Unit	Test 1 Test 2				
Bandwidth		MHz			10		
PDSCH transmissi	on mode				9		
	$ ho_{\scriptscriptstyle A}$	dB			0		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0		
allocation	P_c	dB			-3		
	σ	dB	-3				
Cell-specific referen			Antenna	a ports 0, 1			
CSI reference si				Antenna p	orts 15,,18		
CSI-RS periodicity and subframe offset Tcsi-rs / ∆csi-rs				;	5/1		
CSI reference signal c	onfiguration				0		
Propagation condition configuration	and antenna			Clause	B.1 (4 x 2)		
Beamforming Model				As specified i	in Section B.4.3	3	
CodeBookSubsetRestr					00 0100 0000		
SNR (Note 2		dB	7	8	13	14	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-91	-90	-85	-84	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-(98	-9	8	
Max number of HARQ t	ransmissions				1		
Physical channel for	CQI/PMI			PUSCI	H (Note3)		
reporting	(OOL/DMI				. ,		
PUCCH Report Type 1				DUIGOL	2		
Physical channel for F				PUCCE	Format 2		
	I Report Type for RI orting periodicity ms			A /	3		
	Reporting periodicity		N _{pd} = 5				
CQI delay		ms	8				
cqi-pmi-Configurat					2		
ri-ConfigInde					1		
Note 1: Reference m	easurement ch	annel RC.7 FDD ac	cording to Ta	ble A.4-1 with	n one sided dyn	amic OCNG	

Note 1: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

9.2.3.1A FDD (With *channelMeasRestriction* configured)

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.3.1A-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI_1 = wideband CQI_0 - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.2.3.1A-1: PUCCH 1-1 static test (FDD)

Parameter	Unit	Tes		Tes	st 2
Bandwidth	MHz			10	
PDSCH transmission mode				9	
$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power $ ho_{\scriptscriptstyle B}$	dB			0	
allocation P_c	dB			-3	
σ	dB			-3	
Cell-specific reference signals			Antenna	ports 0, 1	
e-MIMO Type				ass B	
Number of CSI-RS resource (K)		1			
channelMeasRestriction			Er	nable	
CSI reference signals			Antenna p	orts 15,,18	
CSI-RS periodicity and subframe					
offset				5/1	
$T_{ extsf{CSI-RS}}$ / $\Delta_{ extsf{CSI-RS}}$					
CSI reference signal configuration				0	
Propagation condition and antenna			Clause	B.1 (4 x 2)	
configuration					
Beamforming Model				in Section B.4.3	3
CodeBookSubsetRestriction bitmap		0x0000 0000 0100 0000			
SNR (Note 2)	dB	[7]	[8]	[13]	[14]
$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-91	-90	-85	-84
$N_{oc}^{(j)}$	dB[mW/15kHz]	-9	8	-9	8
Max number of HARQ transmissions				1	
Physical channel for CQI/PMI			DUISCI	H (Note3)	
reporting			FUSCI	i (Notes)	
PUCCH Report Type for CQI/PMI				2	
Physical channel for RI reporting			PUCCH	l Format 2	
PUCCH Report Type for RI		3			
Reporting periodicity	ms	$N_{pd} = 10$			
CQI delay	ms			8	
cqi-pmi-ConfigurationIndex				12	
ri-ConfigIndex				1	
PDSCH scheduled sub-frames			1,2,3	,4,7,8,9	

- Note 1: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink #5.
- Note 4: In sub-frame 6, transmission power of CSI-RS REs is 9dB lower than CRS REs, in sub-frame 1, there is no power offset between CSI-RS REs and CRS REs.

9.2.3.2 TDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.2.3.2-1: PUCCH 1-1 submode 1 static test (TDD)

Parameter		Unit	Te	Test 1 Test 2		st 2	
Bandwidth		MHz			10		
PDSCH transmission mode					9		
Uplink downlink configuration			2				
Special subframe co	nfiguration				4		
	$ ho_{\scriptscriptstyle A}$	dB 0					
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	P_c	dB	-6				
	σ	dB					
CRS reference s	ignals			Antenna	ports 0, 1		
CSI reference si	gnals			Antenna p	orts 15,,22		
CSI-RS periodicity an	d subframe						
offset				5	5/ 3		
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$							
CSI reference signal c			0				
Propagation condition and antenna			Clause B.1 (8 x 2)				
configuration			, ,				
Beamforming Model					n Section B.4.		
CodeBookSubsetRestr		0x0000 0000 0020 0000 0000 0001 0000					
SNR (Note 2)		dB	4	5	10	11	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-88	-87	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98		
Max number of HARQ transmissions					1		
Physical channel for CQI/PMI			PUSCH (Note 3)				
reporting			FOSCIT (Note 3)				
PUCCH Report Type for CQI/second PMI			2b				
Physical channel for F		PUSCH					
PUCCH Report Type fo		5					
Reporting perio	ms	$N_{pd} = 5$					
CQI delay	ms	10 or 11					
cqi-pmi-Configurat		3					
ri-ConfigInde		805 (Note 4)					
ACK/NACK feedba		Multiplexing					

- Note 1: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

9.2.3.2A TDD (With *channelMeasRestriction* configured)

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.3.2A-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI_1 = wideband CQI_0 - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median $CQI_0 - 1$ and median $CQI_1 - 1$ shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median $CQI_0 + 1$ and median $CQI_1 + 1$ shall be greater than or equal to 0.1.

Table 9.2.3.2A-1: PUCCH 1-1 submode 1 static test (TDD)

Parameter		Unit	Test 1 Tes		st 2		
Bandwidth		MHz			10		
PDSCH transmission mode					9		
Uplink downlink configuration					2		
Special subframe cor	nfiguration		4				
	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	P_c	dB	*-				
	σ	dB	-3				
CRS reference s	ignals			Antenna	ports 0, 1		
e-MIMO Typ	e			Cla	ass B		
Number of CSI-RS re	source (K)				1		
channelMeasRes	triction			Er	nable		
CSI reference si	gnals			Antenna p	orts 15,,22		
CSI-RS periodicity and	d subframe						
offset				5	5/ 3		
$T_{ extsf{CSI-RS}}$ / $\Delta_{ extsf{CSI-RS}}$	RS						
CSI reference signal c		0					
Propagation condition and antenna			Clause B.1 (8 x 2)				
configuration							
Beamforming Model					n Section B.4.3		
CodeBookSubsetRestriction bitmap			0x0000 0000 0020 0000 0000 0001 0000				
SNR (Note 2)		dB	[4]	[5]]10]	[11]	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-94	-93	-88	-87	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		18		
Max number of HARQ transmissions					1		
Physical channel for CQI/PMI			PUSCH (Note 3)				
reporting			PUSCH (Note 3)				
PUCCH Report Type for CQI/second PMI			2b				
Physical channel for RI reporting			PUSCH				
PUCCH Report Type for RI/ first PMI			5				
Reporting periodicity		ms	N _{Pd} = 10				
CQI delay		ms	10 or 11				
cqi-pmi-ConfigurationIndex			13				
ri-ConfigIndex			805 (Note 4)				
ACK/NACK feedback mode			Multiplexing				
PDSCH scheduled s				,4,9			
Nets 4: Defendance s		1 DO 7 TDD		النام ٨ ماما	, ,,,,	. 00110	

- Note 1: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.
- Note 5: In sub-frame 8, transmission power of CSI-RS REs is 9dB lower than CRS REs, in sub-frame 3, there is no power offset between CSI-RS REs and CRS REs.

9.2.4 Minimum requirement PUCCH 1-1 (With Single CSI Process)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI

median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

If UE supporting *interferenceMeasRestriction*, test cases specified in 9.2.4.1A and 9.2.4.2A are applicable for such UE otherwise test cases specified in 9.2.4.1 and 9.2.4.2 are applied.

9.2.4.1 FDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.4.1-1, and using the downlink physical channels specified in Tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.2.4.1-1: PUCCH 1-1 static test (FDD)

Parameter			Test 1			Test 2		
		Unit	TP1	TP2		TP1	TP2	
Bandwidth		MHz	10					
PDSCH transmission mode					1	0		
<u>_</u>	$ ho_{\scriptscriptstyle A}$	dB	0	0		0	0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0	0		0	0	
allocation (Note 1)	Pc	dB	-3	-3		-3	-3	
	σ	dB	-3	N/	A	-3 N		/A
Cell ID			C)		(0	
Cell-specific reference	ce signals		Antenna ports 0, 1	(Note 2)		Antenna ports 0, 1	(Note 2)	
CSI reference signal	ls		Antenna ports 15,,18	N/	A	Antenna ports 15,,18	N/A	
CSI-RS periodicity a subframe offset Tcs			5/1	N/	A	5/1	N/A	
CSI-RS configuration			0	N/	A	0	N/A	
Zero-Power CSI-RS configuration IcSI-RS / ZeroPowerC bitmap			1 / 001000000000 0000	1 / 10000000000 00000		1 / 001000000000 0000	1 / 10000000000 00000	
CSI-IM configuration Icsi-RS / ZeroPowerCSI-RS bitmap			1 / 001000000000 0000	N/A		1 / 001000000000 0000	N/A	
CSI process configuration Signal/Interference/Reporting mode			CSI-RS/CSI-IM/PUCCH 1-1		CSI-RS/CSI-IM/PUCCH 1-1			
Propagation condition and antenna configuration			Clause B.1 (4 x 2)	Clause (2 x		Clause B.1 (4 x 2)	Clause B.1 (2 x 2)	
CodeBookSubsetRestriction bitmap			0x0000 0000 0100 0000	1000	000	0x0000 0000 0100 0000	100000	
SNR (Note 3)		dB	20	6	7	20	14	15
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-78	-92	-91	-78	-84	-83
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98		-98			
Modulation / Informa payload	ation bit		(Note4)	QPSK / 4392		(Note4)	QPSK / 4392	
Max number of HARQ transmissions			1	N/A		1	N/A	
Physical channel for CQI/PMI reporting			PUSCH (Note5)	N/A		PUSCH (Note5)	N/A	
PUCCH Report Type for CQI/PMI			2	N/A		2	N/A	
PUCCH Report Type for RI			3	N/A		3	N/A	
Reporting periodicity		ms	$N_{pd} = 5$	N/A		$N_{pd} = 5$	N/A	
CQI Delay		ms	8	N/A		8	N/A	
cqi-pmi-ConfigurationIndex			2	N/A		2	N/A	
ri-ConfigIndex			1	N/.	A	1	N/A	
PDSCH scheduled sub-frames			1,2,3,4,6,7,8,9			1,2,3,4,6,7,8,9		
Timing offset between	0 0				-			
Frequency offset bet		Hz	C)	

Note1: Reference measurement channel RC.10 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 5: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

Note 2: REs for antenna ports 0 and 1 CRS have zero transmission power.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 4: N/A.

9.2.4.1A FDD (With *interferenceMeasRestriction* configured)

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.4.1A-1, and using the downlink physical channels specified in Tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.2.4.1A-1: PUCCH 1-1 static test (FDD)

Parameter		Unit	Test 1			Test 2				
			TP1	TF		TP1	TP2			
Bandwidth			MHz	10						
PDSCH tra	PDSCH transmission mode					0	1			
		$ ho_{\scriptscriptstyle A}$	dB	0	0		0	0		
Downlink p		$ ho_{\scriptscriptstyle B}$	dB	0			0	0		
allocation ((Note 1)	Pc	dB	-3	-(-3		3	
		σ	dB	-3	N/	Ά	-3	N	/A	
Cell ID				C)		0			
Cell-specifi	ic referer	nce signals		Antenna ports 0, 1	(Note 2)		Antenna ports 0, 1	(No	te 2)	
e-MIMO Ty				Class B						
		resource (K)		1 Enable						
interferenc	eivieaski	estriction		•	1	Ena		1		
CSI referer				Antenna ports 15,,18	N/	Ά	Antenna ports 15,,18	N/A		
CSI-RS pe offset T _{CSI}		and subframe		5/1	N/	Ά	5/1	N/A		
CSI-RS co	nfiguratio	on		0	N/	Ά	0	N/A		
Zero-Power CSI-RS configuration Icsi-Rs / ZeroPowerCSI-RS bitmap				1 / 001000000000 0000	1 / 10000000000 00000		1 / 001000000000 0000	1 / 10000000000 00000		
CSI-IM configuration Icsi-Rs / ZeroPowerCSI-RS bitmap				1 / 001000000000 0000	N/A		1 / 001000000000 0000	N/A		
CSI process configuration Signal/Interference/Reporting mode			CSI-RS/CSI-IM/PUCCH 1-1			CSI-RS/CSI-IM/PUCCH 1-1				
Propagation condition and antenna configuration			Clause B.1 (4 x 2)	Claus (2 x		Clause B.1 (4 x 2)	Clause B.1 (2 x 2)			
CodeBookSubsetRestriction bitmap			0x0000 0000 0100 0000	100000		0x0000 0000 0100 0000	100000			
SNR	Sub-fra	ame 6	٩D	20	[15]	[16]	20	[23]	[24]	
(Note 3)	Other s	sub-frames	dB	20	6	7	20	14	15	
î (j)	Sub-fra	ame 6	-ID[)A//45[-II-]	-78	[-83]	[-82]	-78	[-75]	[-74]	
$\hat{I}_{or}^{(j)}$	Other s	sub-frames	dB[mW/15kHz]	-78	-92	-91	-78	-84	-83	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98		-98					
Modulation / Information bit payload			(Note4)	QPSK / 4392		(Note4)	QPSK / 4392			
Max number of HARQ transmissions			1	N/A		1	N/A			
Physical channel for CQI/PMI reporting			PUSCH (Note5)	N/A		PUSCH (Note5)	N/A			
PUCCH Report Type for CQI/PMI			2	N/A		2	N/A			
PUCCH Report Type for RI			3	N/A		3	N	/A		
Reporting periodicity		ms	$N_{pd} = 10$	N/A		$N_{pd} = 10$	N/A			
CQI Delay		ms	8	N/A		8		/A		
cqi-pmi-ConfigurationIndex			12	N/A N/A		12		/A		
ri-ConfigIndex PDSCH scheduled sub-frames				1 2 2 4 7 9 0			1 2 2 4 7 9 0	N/A 1,2,3,4,6,7,8,9		
Timing offset between TPs			us	1,2,3,4,7,8,9 1,2,3,4,6,7,8,9 1,2,3		1,2,3,4,7,8,9	0			
		etween TPs	Hz	0				0		
	2551 50				-		·	-		

Note1:	Reference measurement channel RC.10 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern
	OP.1 FDD as described in Annex A.5.1.1.
NI-4- O.	DE- for entering months 0 and 4 ODO have more transmission movem

Note 2: REs for antenna ports 0 and 1 CRS have zero transmission power.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 4: N/A.

Note 5: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink #5.

9.2.4.2 TDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.4.2-1, and using the downlink physical channels specified in Tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI_1 = wideband CQI_0 - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.2.4.2-1: PUCCH 1-1 static test (TDD)

Parameter		Unit	Test 1		Test 2				
			TP1	TP		TP1	TI	2	
Bandwidth		MHz	10						
PDSCH transmission mode Uplink downlink configuration			10 2						
Special subframe of						<u> </u>			
Special Subfraffie G		dB	0	0		0	,)	
Downlink nower	$\rho_{\scriptscriptstyle A}$	_		_				_	
Downlink power allocation (Note 1)	$\rho_{\scriptscriptstyle B}$	dB	0	0		0)	
anocation (Note 1)	Pc	dB	-6	-6		-6		6	
	σ	dB	-3	N/	A	-3		/A	
Cell ID			С)		C)		
Cell-specific referer	nce signals		Antenna ports 0, 1	(Note	e 2)	Antenna ports 0, 1	(No	te 2)	
CSI reference signa	als		Antenna ports 15,,22	N/	A	Antenna ports 15,,22	N.	/A	
CSI-RS periodicity a subframe offset Tc			5/3	N/.	A	5/3	N.	/A	
CSI-RS configuration			0	N/	A	0	N	/A	
Zero-Power CSI-RS configuration IcsI-RS / ZeroPower(bitmap			3 / 001000000000 0000	3 100001 000	00000	3 / 001000000000 0000	10000	/ 100000 000	
CSI-IM configuratio IcsI-Rs / ZeroPowerC bitmap	CSI-RS		3 / 001000000000 0000	N/A		3 / 001000000000 0000	N	N/A	
CSI process configuration Signal/Interference/Reporting mode			CSI-RS/CSI-IN	SI-IM/PUCCH 1-1		CSI-RS/CSI-IM/PUCCH		- 1 1-1	
Propagation condition and antenna configuration			Clause B.1 (8 x 2)	Clause B.1 Clause B.1 (2 x 2) (8 x 2)		(8 x 2)	Claus (2:		
CodeBookSubsetRobitmap	estriction		0x0000 0000 0020 0000 0000 0001 0000	1000	000	0x0000 0000 0020 0000 0000 0001 0000	100	000	
SNR (Note 3)		dB	17	6	7	17	14	15	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-81	-92	-91	-81	-84	-83	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	8		-98			
Modulation / Information / Information			(Note4)	QPSK /	4392	(Note4)	QPSK	/ 4392	
Max number of HAF transmissions			1	N/	Α	1	N/A		
Physical channel for CQI/PMI reporting			PUSCH (Note5)	N/	A	PUSCH (Note5)	N/A		
PUCCH Report Type for CQI/second PMI			2b	N/		2b		/A	
Physical channel fo			PUSCH	N/	A	PUSCH	N	/A	
PUCCH Report Type for RI/ first PMI			5	N/.		5		/A	
Reporting periodicity		ms	$N_{pd} = 5$	N/		$N_{\rm pd} = 5$			
CQI Delay cqi-pmi-ConfigurationIndex		ms	10 or 11 3	N/.		10 or 11 3		/A /A	
ri-ConfigIndex	Jilliuex		805 (Note 6)	N/		805 (Note 6)		<u>/A</u> /A	
ACK/NACK feedba	ck mode		Multiplexing	N/.		Multiplexing		/A /A	
PDSCH scheduled			3,4,		, ,	3,4,		,,,	
Timing offset betwe		us	3,4,			3,4,			
Frequency offset be		Hz	C			C			

Note1:	Reference measurement channel RC.10 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern
	OP 1 TDD as described in Anney 4 5 2 1

- Note 2: REs for antenna ports 0 and 1 CRS have zero transmission power.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: N/A.
- Note 5: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 6: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

9.2.4.2A TDD (With interferenceMeasRestriction configured)

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.2.4.2A-1, and using the downlink physical channels specified in Tables C.3.4-1 and C.3.4-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI_1 = wideband CQI_0 - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.2.4.2A-1: PUCCH 1-1 static test (TDD)

Parameter Bandwidth		Unit	Tes				Test 2 TP1 TP2			
		MHz	TP1	TF		TP1	11	J <u>2</u>		
PDSCH transmission mode		IVIHZ	10							
Uplink downlink configuration			2							
Special subfr							4			
		$\rho_{\scriptscriptstyle A}$	dB	0	()	0	()	
Downlink pov	wor									
allocation (No		$\rho_{\scriptscriptstyle B}$	dB	0	C		0)	
anocation (14)	0.0 1)	Pc	dB	-6	-(-6		6	
		σ	dB	-3	N/	Α	-3		/A	
Cell ID				C)		()		
Cell-specific	referen	ce signals		Antenna ports 0, 1	(Not	e 2)	Antenna ports 0, 1	(No	te 2)	
e-MIMO Type	е						ss B			
Number of C							1			
interferencel	MeasRe	estriction			I	En	able	I		
CSI referenc	e signa	ls		Antenna ports 15,,22	N/	'A	Antenna ports 15,,22	N.	/A	
CSI-RS perio				5/3	N/	'A	5/3	N.	/A	
CSI-RS confi	iguratio	n		0	N/	'A	0	N.	/A	
Zero-Power of configuration Icsi-Rs / Zerol bitmap				3 / 001000000000 0000	3 100001 000	00000	3 / 001000000000 0000	10000	3 / 10000100000 00000	
CSI-IM config I _{CSI-RS} / Zerol bitmap	CSI-IM configuration Icsi-RS / ZeroPowerCSI-RS			3 / 001000000000 0000	N/A		3 / 001000000000 0000	N/A		
CSI process Signal/Interfer mode				CSI-RS/CSI-IM/PUCCH 1-1		CSI-RS/CSI-IM/PUCCH 1-1		Ⅎ 1-1		
Propagation	Propagation condition and antenna configuration			Clause B.1 (8 x 2)	Clause B.1 (2 x 2)		Clause B.1 (8 x 2)	Clause B.1 (2 x 2)		
CodeBookSu bitmap	ıbsetR€	estriction		0x0000 0000 0020 0000 0000 0001 0000	100000		0x0000 0000 0020 0000 0000 0001 0000		000	
SNR (Note	Sub-f	rame 8		17	[15]	[16]	17	[23]	[24]	
3)	Other	sub-frames	dB	17	6	7	17	14	15	
		rame 8		-81	[-83]	[-82]	-81	[-75]	[-74]	
$\hat{I}_{or}^{(j)}$		sub-frames	dB[mW/15kHz]	-81	-92	-91	-81	-84	-83	
$N_{oc}^{(j)}$			dB[mW/15kHz]	-9			-98			
Modulation / payload	Informa	ation bit		(Note4)	QPSK	/ 4392	(Note4)	(Note4) QPSK / 4392		
Max number of HARQ transmissions			1	N/	'A	1	N/A			
reporting	Physical channel for CQI/PMI reporting			PUSCH (Note5)	N/	'A	PUSCH (Note5)	N.	/A	
PUCCH Report Type for CQI/second PMI			2b	N/		2b	N/A			
Physical cha				PUSCH	N/	Ά	PUSCH	N.	/A	
PUCCH Report Type for RI/ first PMI			5	N/		5	N/A			
Reporting pe	riodicit	y	ms	$N_{pd} = 10$	N/		$N_{pd} = 10$	N/A		
CQI Delay			ms	10 or 11	N/		10 or 11		/A	
cqi-pmi-Cont		onIndex		13	N/		13		/A	
ri-ConfigInde		ale ma ele		805 (Note 6)	N/		805 (Note 6)		/A	
ACK/NACK f				Multiplexing 3,4,9	N/		Multiplexing 3,4,9		/A	
	ouitu :	סטוויםווולט		3,4,9	3,4,	0,3	3,4,9		,8,9	

Frequency offset between TPs		Hz	0	0		
Note1: Reference measurement channel RC.10 TDD according to Table A.4-1 with one sided dynamic OCNG Patter						
	OP.1 TDD as described	in Annex A.5.2.1		•		
Note 2:	REs for antenna ports (and 1 CRS have	zero transmission power.			
Note 3:	: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.					
Note 4:	N/A.					
Note 5:		I format 0 shall be	orts and HARQ-ACK it is necessary transmitted in downlink SF#3 to all SF#7.			
Note 6:	CQI/PMI and HARQ-A0	CK reports. In the or RI and HARQ-ACK	n allowable length of 160ms to minicase when all three reports collide, in will be multiplexed. At eNB, CQI retion.	t is expected that CQI/PMI reports		

9.2.5 Minimum requirement PUCCH 1-1 (when *csi-SubframeSet –r12* and *EIMTA-MainConfigServCell-r12* are configured)

The following requirements apply to UE Category ≥ 2 which supports eIMTA TDD UL-DL reconfiguration for TDD serving cell(s) via monitoring PDCCH with eIMTA-RNTI and Rel-12 CSI subframe sets. For the parameters specified in table 9.2.5-1, and using the downlink physical channels specified in Tables C.3.2-1 and C.3.2-2, for each CSI subframe set, the reported CQI value shall be in the range of ± 1 of the reported median more than 90% of the time. For each CSI subframe set, if the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI - 1) shall be less than or equal to 0.1. The difference of the median CQI obtained by reports in CSI subframe sets $C_{CSI,0}$ and the median CQI obtained by reports in CSI subframe sets $C_{CSI,0}$ and the median CQI obtained by reports in CSI subframe sets $C_{CSI,0}$ and the median CQI obtained by reports in CSI subframe sets $C_{CSI,0}$ shall be larger than or equal to 3.

Table 9.2.5 -1: PUCCH 1-1 static test (TDD)

Parameter	•	Unit	Test		
Bandwidth		MHz		10	
PDSCH transmission m				9	
Uplink downlink configu Downlink HARQ referen				0	
configuration (eimta-	ice			2	
HarqReferenceConfig-r	12) (Note 4)			_	
Set of dynamic TDD UL	-DL				
configurations (Notes 4,			{0), 2}	
Periodicity of monitoring					
reconfiguration DCI (ein		ms	•	10	
CommandPeriodicity-r1					
Set of subframes to more reconfiguration DCI (ein			C)	F#5	
CommandSubframeSet			31	F#3	
CSI-MeasSubframeSet-			0001	100011	
Special subframe config				4	
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power	$\rho_{\scriptscriptstyle B}$	dB		0	
allocation	P_c	dB		0	
	σ	dB		-3	
CRS reference signals				ports 0, 1	
CSI reference signals			Antenna	ports 15,16	
CSI-RS periodicity and soffset	subframe		5	5/4	
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$					
CSI reference signal co	nfiguration			4	
Zero-Power CSI-RS cor				0/	
I _{CSI-RS} / ZeroPowerCSI-I Zero-Power CSI-RS cor				000000000 4 /	
Icsi-Rs / ZeroPowerCSI-I				00000000	
Propagation condition a				3.1 (2 x 2)	
configuration Beamforming Model				n Section B.4.3	
CodeBookSubsetRestri	ction hitman		•	0001'	
SNR in CSI subframe se		dB	0 1		
SNR in CSI subframe se		dB	10	11	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	
$N_{ac1}^{(j)}$ for CSI subframe se	et 0	dB[mW/15kHz]	-98	-98	
$N_{oc2}^{(j)}$ for CSI subframe se	et 1	dB[mW/15kHz]	-108	-108	
PDSCH scheduled subf		-),5	
CSI subframe set 0				·,·	
PDSCH scheduled subf	rames for		3,4	1,8,9	
CSI subframe set 1 Max number of HARQ to	ransmissions		·	1	
Physical channel for CC					
reporting			PUSCH	I (Note 6)	
PUCCH Report Type for CQI/second PMI			2	2b	
Physical channel for RI	reportina		PU	SCH	
PUCCH Report Type for RI/ first PMI				5	
Reporting periodicity		ms		el-12 CSI subframe set	
CQI delay		ms	14 for CSI s	ubframe set 0 ubframe set 1	
cqi-pmi-ConfigurationIn	dex		8 foi	r set 0	
				or set 1 and set 1 (Note 7)	
ri-ConfigIndex ACK/NACK feedback m	ode			plexing	
ACIVINACIA IEEUDACK III	ou c		iviuitij	UIGAIIIY	

Note 1:	Reference measurement channel RC.19 TDD according to Table A.4-1 with one sided dynamic
	OCNG Pattern OP.1 TDD and dynamic OCNG Pattern with multiple non-contiguous blocks OP.7
	TDD as described in Annex A.5.2.1/7 for CSI subframe set 0.

- Note 2: Reference measurement channel RC.20 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 for CSI subframe set 1.
- Note 3: In the test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level for each CSI subframe set separately.
- Note 4: As specified in Table 4.2-2 in TS 36.211.
- Note 5: UL/DL configuration in PDCCH with eIMTA-RNTI is cyclically selected from the given set on a per-DCI basis.
- Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2. CQI/PMI reports for CSI subframe set 0 is transmitted in SF#2 and CQI/PMI reports for CSI subframe set 1 is transmitted in SF#7
- Note 7: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

9.2.6 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbols)

9.2.6.1 Frame structure type 3 with FDD Pcell

The following requirements apply to UE Category ≥1. For the parameters specified in Table 9.2.6.1-1, Table 9.2.6.1-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, two sets of CQI reports are obtained for LAA Scell. The first one is obtained by reports whose reference resource is in the downlink subframes with 6 dB transmission power boost, i.e., high power subframes. The second one is obtained by reports whose reference resource is in the downlink subframe with 0 dB transmission power boost, i.e., low power subframe. In the test, PDSCH transport format in high power subframe is determined by first set of CQI reports and PDSCH transport format in low power subframe is determined by second set of CQI reports.

The reported CQI value in the first set of reports shall be in the range of ± 1 of the reported median more than 90% of the first set of reports. The reported CQI value in the second set of reports shall be in the range of ± 1 of the reported median more than 90% of the second set of reports.

If the PDSCH BLER in the high power subframes using the transport format indicated by wideband CQI median is less than or equal to 0.1, the BLER in high power subframes using the transport format indicated by the (wideband CQI median + 1) shall be greater than 0.1. If the PDSCH BLER in the high power subframes using the transport format indicated by the wideband CQI median is greater than 0.1, the BLER in high power subframes using transport format indicated by (wideband CQI median - 1) shall be less than or equal to 0.1.

If the PDSCH BLER in the low power subframes using the transport format indicated by wideband CQI median is less than or equal to 0.1, the BLER in low power subframes using the transport format indicated by the (wideband CQI median + 1) shall be greater than 0.1. If the PDSCH BLER in the low power subframes using the transport format indicated by the wideband CQI median is greater than 0.1, the BLER in low power subframes using transport format indicated by (wideband CQI median - 1) shall be less than or equal to 0.1.

The value of the wideband CQI median for first set of CQI reports minus the wideband CQI median for second set of CQI reports shall be larger than or equal to 2 in Test 1 and Test 2.

Table 9.2.6.1-1: Parmeters for PUSCH 3-0 static test on FDD Pcell

Parameter		Unit	Value
Bandwidth		MHz	20
PDSCH transmission	n mode		3
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
	σ	dB	0
	Propagation condition and antenna configuration		Clause B.1 (2 x 2)
SNR		dB	20
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-78
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Max number of HARQ transmissions			1
Reporting mode			PUSCH 3-0
CSI request fi	eld		'10'
trigger1 (Note	2)		01000000
trigger2 (Note	2)		00000000

Note 1: PCell is used for HARQ ACK/NACK feedback and aperiodic CSI triggering/reporting. One sided dynamic OCNG Pattern OP.1 FDD as described in A.5.1.1 is transmitted on PCell on all RBs, but PDSCH for user data is not transmitted on PCell.

Note 2: trigger1 and trigger2 are defined as TS 36.331 for aperiodicCSI-Trigger.
They Indicate for which serving cell(s) the aperiodic CSI report is triggered when one or more SCells are configured. PDCCH DCI format 0 with a trigger for aperiodic CQI is transmitted periodically in subframe 1 and subframe 6 with 5ms periodicity.

Table 9.2.6.1-2: PUSCH 3-0 static test on LAA Scell

Parameter			Unit	Test 1	Test 2		
	Bandwi		MHz	20			
PDSCH	PDSCH transmission mode			3			
Downlink po	wor	$ ho_{\scriptscriptstyle A}$	dB	-3			
allocation		$ ho_{\scriptscriptstyle B}$	dB	-3	3		
		σ	dB	0	1		
C	onfigur			Clause B	.1 (2x2)		
	rames v	with 6 dB power ote 2)	dB	9	10		
	rames v	with 0 dB power ote 2)	dB	3	4		
$\hat{I}_{or}^{(j)}$ in subf	rames v	with 6 dB power	dB[mW/15kHz]	-89	-88		
$\hat{I}_{or}^{(j)}$ in subf	rames v	with 0 dB power	dB[mW/15kHz]	-95	-94		
	$N_{oc}^{(j)}$		dB[mW/15kHz]	-98			
MBSFN su	ıbframe	Configuration		Non-MBSFN			
	Cell I			0			
	tc-Peri		ms	80			
	dmtc-O			0			
		OFDM symbols		3			
		Q transmissions		1			
Re	porting			PUSCH 3-0			
		Basic model		As specified in Section B.8			
		ameStartPosition		s0			
		ber of occupied ols per subframe		14	4		
PDSCH transmission	T	The number of ames set (\$1) per burst		{3,8}			
model		ndom variable <i>p</i> lefined in B.8		0.5			
	Power configuration for each burst			$\hat{I}_{or}^{(j)}$ is randomly so power boosting boosting with ed	or 0 dB power qual probability		
Note 1: Reference measurement channel RC.2A FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FS3 as described in Annex A.5.4.1, except for							

Note 1: Reference measurement channel RC.2A FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FS3 as described in Annex A.5.4.1, except for category 1 UE use RC.4A FDD with two sided dynamic OCNG Pattern OP.2 FS3 as described in Annex A.5.4.2.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

9.2.6.2 Frame structure type 3 with TDD Pcell

The following requirements apply to UE Category ≥1. For the parameters specified in Table 9.2.6.2-1, Table 9.2.6.2-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, two sets of CQI reports are obtained for LAA Scell. The first one is obtained by reports whose reference resource is in the downlink subframes with 6 dB transmission power boost, i.e., high power subframes. The second one is obtained by reports whose reference resource is in the downlink subframe with 0 dB transmission power boost, i.e., low power subframe. In the test, PDSCH transport format in high power subframe is determined by first set of CQI reports and PDSCH transport format in low power subframe is determined by second set of CQI reports.

The reported CQI value in the first set of reports shall be in the range of ± 1 of the reported median more than 90% of the first set of reports. The reported CQI value in the second set of reports shall be in the range of ± 1 of the reported median more than 90% of the second set of reports.

If the PDSCH BLER in the high power subframes using the transport format indicated by wideband CQI median is less than or equal to 0.1, the BLER in high power subframes using the transport format indicated by the (wideband CQI

median + 1) shall be greater than 0.1. If the PDSCH BLER in the high power subframes using the transport format indicated by the wideband CQI median is greater than 0.1, the BLER in high power subframes using transport format indicated by (wideband CQI median - 1) shall be less than or equal to 0.1.

If the PDSCH BLER in the low power subframes using the transport format indicated by wideband CQI median is less than or equal to 0.1, the BLER in low power subframes using the transport format indicated by the (wideband CQI median + 1) shall be greater than 0.1. If the PDSCH BLER in the low power subframes using the transport format indicated by the wideband CQI median is greater than 0.1, the BLER in low power subframes using transport format indicated by (wideband CQI median - 1) shall be less than or equal to 0.1.

The value of the wideband CQI median for first set of CQI reports minus the wideband CQI median for second set of CQI reports shall be larger than or equal to 2 in Test 1 and Test 2.

Table 9.2.6.2-1: Parmeters for PUSCH 3-0 static test on TDD Pcell

Parameter		Unit	Value
Bandwidth		MHz	20
Uplink downlink conf			2
Special subfra configuration			4
PDSCH transmission	n mode		3
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
	σ	dB	0
Propagation condition and antenna configuration			Clause B.1 (2 x 2)
SNR		dB	20
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-78
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Max number of HARQ transmissions			1
Reporting mode			PUSCH 3-0
CSI request field			'10'
trigger1 (Note	2)		01000000
trigger2 (Note	2)		00000000

Note 1: PCell is used for HARQ ACK/NACK feedback and aperiodic CSI triggering/reporting. One sided dynamic OCNG Pattern OP.1 TDD as described in A.5.2.1 is transmitted on PCell on all RBs, but PDSCH for user data is not transmitted on PCell.

Note 2: trigger1 and trigger2 are defined as TS 36.331 for aperiodicCSI-Trigger. They Indicate for which serving cell(s) the aperiodic CSI report is triggered when one or more SCells are configured. PDCCH DCI format 0 with a trigger for aperiodic CQI is transmitted periodically in subframe 3 and subframe 8 with 5ms periodicity.

Table 9.2.6.2-2: PUSCH 3-0 static test on LAA Scell

Parameter			Unit	Test 1	Test 2	
	Bandwi		MHz	20		
PDSCH	transmi	ssion mode		3		
Downlink power $ ho_{\scriptscriptstyle A}$			dB	-3		
allocation		$ ho_{\scriptscriptstyle B}$	dB	-3		
		σ	dB	0		
С	onfigura			Clause B.	1 (2x2)	
bo	ost (No	with 6 dB power ote 2)	dB	9	10	
SNR in subf	rames v	with 0 dB power ote 2)	dB	3	4	
$\hat{I}_{or}^{(j)}$ in subf	rames \	with 6 dB power	dB[mW/15kHz]	-89	-88	
$\hat{I}_{or}^{(j)}$ in subf	rames \	with 0 dB power	dB[mW/15kHz]	-95	-94	
	$N_{oc}^{(j)}$)	dB[mW/15kHz]	-98		
MBSFN su	bframe	Configuration		Non-MBSFN		
	Cell I			0		
dm	tc-Peri	odicity	ms	80		
	dmtc-Of			0		
Number of o	control (OFDM symbols		3		
		Q transmissions		1		
Re	porting			PUSCH 3-0		
		Basic model		As specified in Section B.8		
		ameStartPosition		s0		
		ber of occupied ols per subframe		14		
PDSCH transmission	Subfra	he number of ames set (\$1) per burst		{3,8	3}	
model		ndom variable <i>p</i> lefined in B.8		0.5		
	Powe	r configuration for		$\hat{I}_{or}^{(j)}$ is randomly se	lected from 6 dB	
each burst power boosting or 0 dB power boosting with equal probability						
Note 1: Reference measurement channel RC.2A FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FS3 as described in Annex A.5.4.1, except for category 1 UE use RC.4A FDD with two sided dynamic OCNG Pattern OP.2 FS3 as						

described in Annex A.5.4.2.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

9.2.7 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

9.2.7.1 Frame structure type 3 wth FDD Pcell

The following requirements apply to UE Category ≥1. For the parameters specified in Table 9.2.7.1-1, Table 9.2.7.1-2 and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, two sets of CQI reports are obtained for LAA Scell, The first one is obtained by reports whose reference resource is in the downlink subframes with 6 dB transmission power boost, i.e., high power subframes. The second one is obtained by reports whose reference resource is in the downlink subframe with 0 dB transmission power boost, i.e., low power subframe. In the test, PDSCH transport format in high power subframe is determined by first set of CQI reports and PDSCH transport format in low power subframe is determined by second set of CQI reports.

The reported CQI value in the first set of reports shall be in the range of ± 1 of the reported median more than 90% of the first set of reports. The reported CQI value in the second set of reports shall be in the range of ±1 of the reported median more than 90% of the second set of reports.

If the PDSCH BLER in the high power subframes using the transport format indicated by wideband CQI median is less than or equal to 0.1, the BLER in high power subframes using the transport format indicated by the (wideband CQI median + 1) shall be greater than 0.1. If the PDSCH BLER in high power subframes using the transport format indicated by the wideband CQI median is greater than 0.1, the BLER in high power subframes using transport format indicated by (wideband CQI median - 1) shall be less than or equal to 0.1.

If the PDSCH BLER in the low power subframes using the transport format indicated by wideband CQI median is less than or equal to 0.1, the BLER in low power subframes using the transport format indicated by the (wideband CQI median + 1) shall be greater than 0.1. If the PDSCH BLER in the low power subframes using the transport format indicated by the wideband CQI median is greater than 0.1, the BLER in low power subframes using transport format indicated by (wideband CQI median - 1) shall be less than or equal to 0.1.

The value of the wideband CQI for the first set of CQI report minus the wideband CQI median for second set of CQI shall be larger than or equal to 2 in Test 1 and Test 2.

Table 9.2.7.1-1: Parmeters for PUSCH 3-1 static test on FDD Pcell

Parameter		Unit	Value	
Bandwidth		MHz	20	
PDSCH transmission	on mode		9	
	$ ho_{\scriptscriptstyle A}$	dB	0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0	
allocation	P_c	dB	0	
	σ	dB	0	
Propagation condit antenna configur			Clause B.1 (2 x 2)	
SNR		dB	20	
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$		-78	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	
CRS reference signals			Antenna ports 0	
CSI reference signals			Antenna ports 15, 16	
	CSI-RS periodicity and			
subframe offs			5/ 1	
T _{CSI-RS} / Δ _{CSI-I}				
CSI-RS reference configuration			4	
CodeBookSubsetRe bitmap	estriction		000001	
Number of control OFDM			3	
symbols			3	
Max number of HARQ			1	
transmissions			•	
Reporting mode			PUSCH 3-1	
CSI request fi			'10'	
trigger1 (Note			01000000	
trigger2 (Note	: 2)		00000000	

Note 1: PCell is used for HARQ ACK/NACK feedback and aperiodic CSI triggering/reporting. One sided dynamic OCNG Pattern OP.1 FDD as described in A.5.1.1 is transmitted on PCell on all RBs, but PDSCH for user data is not transmitted on PCell.

Note 2: trigger1 and trigger2 are defined as TS 36.331 for aperiodicCSI-Trigger. They Indicate for which serving cell(s) the aperiodic CSI report is triggered when one or more SCells are configured. PDCCH DCI format 0 with a trigger for aperiodic CQI is transmitted periodically in subframe 1 and subframe 6 with 5ms periodicity.

Table 9.2.7.1-2: PUSCH 3-1 static test on LAA Scell

695

$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Parameter Unit Test 1 Te							
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Band	width	MHz	20 1	ИНz		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Tran	smiss	ion mode		(9		
allocation P_c dB 0 0 dB 0 0 0 0 0 0 0 0 0 0		$ ho_{\scriptscriptstyle A}$		dB	(0		
SNR in subframes with 6 dB power boost (Note 3) SNR in subframes with 0 dB power boost (Note 3) 3 4		er er	$ ho_{\scriptscriptstyle B}$	dB	(0		
SNR in subframes with 6 dB power boost (Note 3) SNR in subframes with 0 dB power boost (Note 3) \$\hat{j}_{or}^{(J)}\$ in subframes with 0 dB power boost (Note 3) \$\hat{j}_{or}^{(J)}\$ in subframes with 0 dB power dB[mW/15kHz] \[\hat{s}_{or}^{(J)}\$ in subframes with 0 dB power dB[mW/15kHz] \[\hat{s}_{or}^{(J)}\$ in subframes with 0 dB power dB[mW/15kHz] \[\hat{s}_{or}^{(J)}\$ in subframes with 0 dB power dB[mW/15kHz] \[\hat{s}_{or}^{(J)}\$ in subframes with 0 dB power dB[mW/15kHz] \[\hat{s}_{or}^{(J)}\$ in subframes with 0 dB power dB[mW/15kHz] \[\hat{s}_{or}^{(J)}\$ by the subframe Configuration and the subframe Configuration and the subframe Configuration and the subframe of the subframe Condition and antenna configuration and the subframe of the subframe configuration and the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe of the subframe subframe and the subframe of the subframe of the subframe subframe of the subframe subframe of the subfr	allocation		P_{c}	dB		0		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				dB		0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	bo	ost (N	Note 3)	dB	9	10		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$					3	4		
$\frac{N_{oc}^{(f)}}{N_{oc}} \qquad \text{dB[mW/15kHz]} \qquad -98 \qquad -98$ $\frac{N_{oc}^{(f)}}{N_{oc}^{(f)}} \qquad \text{Non-MBSFN}$ $\frac{N_{oc}^{(f)}}{N_{oc}^{(f)}} \qquad \frac{N_{oc}^{(f)}}{N_{oc}^{(f)}} \qquad \frac{N_{oc}^{(f)}}{N_{oc$	$\hat{I}_{or}^{(j)}$ in subf	rames	with 6 dB power		-89	-88		
MBSFN subframe Configuration Non-MBSFN Cell Id 0 dmtc-Periodicity ms 80 dmtc-Offset 0 Propagation condition and antenna configuration Clause B.1 (2x2) Beamforming Model As specified in Section B.4.3 CRS reference signals Antenna ports 0 CSI reference signals Antenna ports 15, 16 CSI-RS periodicity and subframe offset T _{CSI-RS} / ACSI-RS 5/ 1 CSI-RS reference signal configuration 4 CodeBookSubsetRestriction bitmap 0000001 Number of control OFDM symbols 3 Max number of HARQ transmissions 1 Reporting mode PUSCH 3-1 Basic model As specified in Section B.8 subframeStartPosition s0 Number of occupied symbols per subframe 14 The number of subframes of subframe of subframe of cocupied symbols per subframe 14 POSCH transmission model For each burst 0.5 Power configuration for each burst 6 dB power boosting or 0 dB power boosting with equal probability Note 1: If the UE reports in an available uplink reporting instance at s	$\hat{I}_{or}^{(j)}$ in subf	rames	with 0 dB power	dB[mW/15kHz]	-95	-94		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		N_o^0	(j) oc	dB[mW/15kHz]	-98	-98		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	MBSFN su				Non-M	1BSFN		
Propagation condition and antenna configuration Clause B.1 (2x2)		Cell	ld			0		
Propagation condition and antenna configuration Clause B.1 (2x2)				ms				
Clause B.1 (222) Beamforming Model As specified in Section B.4.3 CRS reference signals Antenna ports 0 CSI reference signals Antenna ports 15, 16 CSI-RS periodicity and subframe offset TCSI-RS / ACSI-RS CSI-RS periodicity and subframe offset TCSI-RS / ACSI-RS CSI-RS reference signal configuration 4 CodeBookSubsetRestriction bitmap 000001 Number of control OFDM symbols 3 Max number of HARQ transmissions 1 Reporting mode PUSCH 3-1 Basic model As specified in Section B.8 subframeStartPosition S0 Number of occupied symbols per subframe The number of subframes set (\$\frac{1}{2}\$) per \$\frac{1}{2}\$, \$\frac{1}{2}\$, \$\frac{1}{2}\$, \$\frac{1}{2}\$ PDSCH transmission model Power configuration for each burst \$\frac{1}{2}\$ \$					(0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$					Clause B.1 (2x2)			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$					As specified in Section B.4.3			
CSI-RS periodicity and subframe offset \$T_{CSI-RS} / A_{CSI-RS}\$\$ CSI-RS reference signal configuration \$4\$ CodeBookSubsetRestriction bitmap \$000001\$ Number of control OFDM symbols \$3\$ Max number of HARQ transmissions \$1\$ Reporting mode \$PUSCH 3-1\$ Basic model \$As specified in Section B.8 \$subframeStartPosition \$0\$ Number of occupied \$symbols per subframe \$14\$ The number of \$subframes set (\$\sl_1\$) per \$burst\$ Random variable \$p\$ defined in B.8 \$					Antenna	a ports 0		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$					Antenna p	orts 15, 16		
					5/ 1			
					4			
Number of control OFDM symbols 3								
$\begin{array}{ c c c c } \hline \textbf{Reporting mode} & \textbf{PUSCH 3-1} \\ \hline \textbf{Basic model} & \textbf{As specified in Section B.8} \\ \hline \textbf{SubframeStartPosition} & \textbf{s0} \\ \hline \textbf{Number of occupied symbols per subframe} & 14 \\ \hline \textbf{The number of subframes set (\mathbb{S}_1) per burst} \\ \hline \textbf{Random variable } p \\ \hline \textbf{defined in B.8} & \hat{I}_{or}^{(j)} \text{ is randomly selected from 6 dB power boosting or 0 dB power boosting with equal probability} \\ \hline \textbf{Note 1:} & \textbf{If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)} \\ \hline \textbf{Note 2:} & \textbf{Reference measurement channel RC.9A FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FS3 as described in Annex A.5.4.1/2.} \\ \hline \textbf{Note 3:} & \textbf{For each test, the minimum requirements shall be fulfilled for at least one of the two} \\ \hline \end{tabular}$					1			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$					PUSCH 3-1			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$					As specified in Section B.8			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		sub	frameStartPosition		s0			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		Nu	mber of occupied		1	1		
$ \begin{array}{ c c c c c } \hline {\sf PDSCH} \\ {\sf transmission} \\ {\sf model} \\ \hline \end{array} \begin{array}{ c c c c c } \hline {\sf subframes set (\S_1) per} \\ \hline {\sf burst} \\ \hline \hline \\ {\sf Random \ variable \ p} \\ \hline {\sf defined \ in \ B.8} \\ \hline \\ \hline \\ {\sf Power \ configuration \ for} \\ {\sf each \ burst} \\ \hline \\ \hline \\ {\sf Power \ configuration \ for} \\ {\sf each \ burst} \\ \hline \\ \hline \\ \\ \hline \\ \\ \\ \hline \\ \\ \\ \hline \\ \\ \hline \\ \\ \hline \\ \\ \hline \\ \\ \\ \hline \\ \\ \\ \hline \\ \\ \\ \hline \\ \\ \\ \\ \hline \\$						7		
Random variable p defined in B.8 Power configuration for each burst Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4) Note 2: Reference measurement channel RC.9A FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FS3 as described in Annex A.5.4.1/2. Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two			frames set (S1) per		{3,	. 8}		
Power configuration for each burst Comparison of the description of		Ra	andom variable p		0	.5		
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4) Note 2: Reference measurement channel RC.9A FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FS3 as described in Annex A.5.4.1/2. Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two		_			$\hat{I}_{or}^{(j)}$ is random	ly selected from		
CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4) Note 2: Reference measurement channel RC.9A FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FS3 as described in Annex A.5.4.1/2. Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two			each burst		power boosti proba	ng with equal ability		
Note 2: Reference measurement channel RC.9A FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FS3 as described in Annex A.5.4.1/2. Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two	CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband							
Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two	Note 2: Reference measurement channel RC.9A FDD according to Table A.4-1 with one/two							
SNR(s) and the respective wanted signal input level.	Note 3: For e	each t	est, the minimum requ	uirements shall be ful				

9.2.7.2 Frame structure type 3 wth TDD Pcell

The following requirements apply to UE Category ≥ 1 . For the parameters specified in Table 9.2.7.2-1, Table 9.2.7.2-2 and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, two sets of CQI reports are obtained for LAA Scell, The first one is obtained by reports whose reference resource is in the downlink subframes with 6 dB transmission power boost, i.e., high power subframes. The second one is obtained by reports whose reference resource

is in the downlink subframe with 0 dB transmission power boost, i.e., low power subframe. In the test, PDSCH transport format in high power subframe is determined by first set of CQI reports and PDSCH transport format in low power subframe is determined by second set of CQI reports.

The reported CQI value in the first set of reports shall be in the range of ± 1 of the reported median more than 90% of the first set of reports. The reported CQI value in the second set of reports shall be in the range of ± 1 of the reported median more than 90% of the second set of reports.

If the PDSCH BLER in the high power subframes using the transport format indicated by wideband CQI median is less than or equal to 0.1, the BLER in high power subframes using the transport format indicated by the (wideband CQI median + 1) shall be greater than 0.1. If the PDSCH BLER in high power subframes using the transport format indicated by the wideband CQI median is greater than 0.1, the BLER in high power subframes using transport format indicated by (wideband CQI median - 1) shall be less than or equal to 0.1.

If the PDSCH BLER in the low power subframes using the transport format indicated by wideband CQI median is less than or equal to 0.1, the BLER in low power subframes using the transport format indicated by the (wideband CQI median + 1) shall be greater than 0.1. If the PDSCH BLER in the low power subframes using the transport format indicated by the wideband CQI median is greater than 0.1, the BLER in low power subframes using transport format indicated by (wideband CQI median - 1) shall be less than or equal to 0.1.

The value of the wideband CQI for the first set of CQI report minus the wideband CQI median for second set of CQI shall be larger than or equal to 2 in Test 1 and Test 2.

Table 9.2.7.2-1: Parmeters for PUSCH 3-1 static test on TDD Pcell

Parameter	Parameter		Value
Bandwidth	Bandwidth		20
PDSCH transmission	PDSCH transmission mode		9
Uplink downlink conf			2
Special subfra			4
configuration	1		7
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	P_c	dB	0
	σ	dB	0
Propagation condit			Clause B.1 (2 x 2)
antenna configu	ation		` ,
SNR		dB	20
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-78
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
CRS reference signals			Antenna ports 0
CSI reference si	gnals		Antenna ports 15, 16
	CSI-RS periodicity and subframe offset		5/ 1
CSI-RS reference configuration			4
CodeBookSubsetRestriction bitmap			000001
Number of control OFDM symbols			3
Max number of HARQ transmissions			1
Reporting mo	Reporting mode		PUSCH 3-1
CSI request fi	eld		'10'
trigger1 (Note	2)		01000000
trigger2 (Note	2)		00000000

Note 1: PCell is used for HARQ ACK/NACK feedback and aperiodic CSI triggering/reporting. One sided dynamic OCNG Pattern OP.1 TDD as described in A.5.2.1 is transmitted on PCell on all RBs, but PDSCH for user data is not transmitted on PCell.

Note 2: trigger1 and trigger2 are defined as TS 36.331 for aperiodicCSI-Trigger.
They Indicate for which serving cell(s) the aperiodic CSI report is triggered when one or more SCells are configured. PDCCH DCI format 0 with a trigger for aperiodic CQI is transmitted periodically in subframe 3 and subframe 8 with 5ms periodicity.

Table 9.2.7.2-2: PUSCH 3-1 static test on LAA Scell

Parameter		Unit	Test 1	Test 2	
Bandwidth		MHz	20 1	ИНz	
Trans	smission mode		,	9	
	$ ho_{\scriptscriptstyle A}$	dB	()	
	Downlink power $ ho_{\scriptscriptstyle B}$		()	
allocation P_c		dB	()	
	σ		()	
	rames with 6 dB power	dB	9	10	
	post (Note 3)	ub	J	10	
bo	rames with 0 dB power post (Note 3)		3	4	
$\hat{I}_{or}^{(j)}$ in subfi	rames with 6 dB power		-89	-88	
$\hat{I}_{or}^{(j)}$ in subfi	rames with 0 dB power	dB[mW/15kHz]	-95	-94	
	$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98	
MBSFN su	bframe Configuration			IBSFN	
	Cell Id)	
	tc-Periodicity	ms		0	
	Imtc-Offset)	
Propagation condition and antenna configuration			Clause I	3.1 (2x2)	
Beamforming Model			As specified in Section B.4.3		
CRS reference signals				a ports 0	
	eference signals		Antenna p	orts 15, 16	
	icity and subframe offset		5/	′ 3	
CSI-RS refere	_{SI-RS} / Δ _{CSI-RS} ence signal configuration			4	
	ubsetRestriction bitmap		000001		
	control OFDM symbols		3		
	of HARQ transmissions		,	1	
	porting mode		PUSC	CH 3-1	
	Basic model		As specified	n Section B.8	
	subframeStartPosition		S	0	
	Number of occupied		1	4	
	symbols per subframe		·	•	
	The number of			0.)	
PDSCH	subframes set (S ₁) per		{3,	8}	
transmission	burst				
model	Random variable <i>p</i> defined in B.8		0	.5	
	Dower configuration for		$\hat{I}_{or}^{(j)}$ is random	y selected from	
	Power configuration for each burst		6 dB power bo	osting or 0 dB	
	each buist			ng with equal ability	
Note 1: If the	UE reports in an available	uplink reporting insta			
CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)					
	rence measurement chann				
sideo	d dynamic OCNG Pattern C	P.1/2 FS3 as describ	ed in Annex A.5.4	1.1/2.	
	each test, the minimum req		filled for at least o	ne of the two	
SNR(s) and the respective wanted signal input level.					

9.3 CQI reporting under fading conditions

9.3.1 Frequency-selective scheduling mode

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands can be used for frequently-selective scheduling. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

9.3.1.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbols)

9.3.1.1.1 FDD

For the parameters specified in Table 9.3.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.1-1 Sub-band test for single antenna transmission (FDD)

Parameter		Unit	Tes	Test 1 Test 2		st 2
Band	Bandwidth		10 MHz			
Transmiss	sion mode			1 (port 0)		
Downlink	$ ho_{\scriptscriptstyle A}$	dB			0	
power	$ ho_{\scriptscriptstyle B}$	dB		0		
allocation	σ	dB			0	
SNR (Note 3)	dB	9	10	14	15
	(j) or	dB[mW/15kHz]	-89 -88 -84 -8		-83	
N	oc (j)	dB[mW/15kHz]	-98 -98		98	
			Clause B.2.4 with $\tau_d = 0.45 \mu$		0.45μ s,	
Propagation	on channel		$a = 1, f_D = 5 \text{ Hz}$			
Antenna co	onfiguration			1:	x 2	
Reportin	g interval	ms		5		
CQI delay		ms		8		
Reporting mode				PUSCH 3-0		
Sub-band size		RB		6 (ful	l size)	
	er of HARQ iissions			1		

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.3.1.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	2	2
β [%]	55	55
γ	1.1	1.1
UE Category	≥1	≥1

9.3.1.1.2 TDD

For the parameters specified in Table 9.3.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.2-1 Sub-band test for single antenna transmission (TDD)

Parameter		Unit	Te	Test 1 Test 2		
Bandwidth		MHz		10 MHz		
Transmiss	sion mode		1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB		(0	
power	$ ho_{\scriptscriptstyle B}$	dB		(0	
allocation	σ	dB		(0	
	lownlink uration			:	2	
	subframe uration			•	4	
SNR (I	Note 3)	dB	9	10	14	15
	$\hat{I}_{or}^{(j)}$		-89	-88	-84	-83
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98			8
Propagation channel			Clause B.2.4 with $ au_d=0.45~\mu\mathrm{s},~a=1,$ $f_D=5~\mathrm{Hz}$			
Antenna co	onfiguration		1 x 2			
Reporting	g interval	ms		5		
CQI delay		ms		10 or 11		
Reporting mode				PUSC	CH 3-0	
Sub-band size		RB		6 (full size)		
Max number of HARQ transmissions				1		
ACK/NACK feedback mode Multiplexing						
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied						

at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.

For each test, the minimum requirements shall be fulfilled for at least Note 3: one of the two SNR(s) and the respective wanted signal input level.

Table 9.3.1.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	2	2
β [%]	55	55
γ	1.1	1.1
UE Category	≥1	≥1

9.3.1.1.3 FDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.3-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band:
- b) the ratio of the throughput in ABS subframes obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be $\geq \gamma$;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER in ABS subframes for the indicated transport formats shall be greater than or equal to ε .

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.3-1 Sub-band test for single antenna transmission (FDD)

Dorometer		I Imit		Tes	t 1	Test 2		
Parameter		Unit	Ce	II 1	Cell 2 and 3	Cell 1	Cell 2 and 3	
Bandwidth		MHz		10		4	10 Nata 40	
PDSCH transmission		٩D	1 Note 10 1		Note 10			
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0				0	
allocation	$ ho_{\scriptscriptstyle B}$	dB	0			0		
	σ	dB	01	0) 	01 5.0	0	
Propagation con	dition		with To	e B.2.4 I = 0.45	EVA5 Low antenna	Clause B.2 with Td =	L ow antenna	
. 5				: 1, fd = Hz	correlation	0.45 us, a 1, fd = 5 H		
Antenna configu				1x			1x2	
\widehat{E}_s/N_{oc2} (No	te 1)	dB	4	5	Cell 2: 12 Cell 3: 10	14 15	Cell 3: 10	
7. (i)	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (N	lote 7)	N/A	-98 (Note 7	•	
$N_{oc}^{(j)}$ at antenna port	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (N	lote 8)	N/A	-98 (Note 8	•	
	$N_{oc3}^{(j)}$	dBm/15kHz	,	lote 9)	N/A	-93 (Note 9	9) N/A	
Subframe Config	uration		Non-M	/IBSFN	Non-MBSFN	Non-MBSF		
Cell Id				0	Cell 2: 6	0	Cell 2: 6	
			Cell 2: 3 usec		Cell 2: 3 usec			
Time Offset betwe	en Cells	μs		Cell 3: -1usec		Cell 3: -1usec		
Frequency Shift betv	veen Cells	Hz	Cell 2: 300Hz		Cell 2: 300Hz			
- 1,				Cell 3: -	01010101	Cel	1 3: -100Hz 01010101	
					01010101		01010101	
ABS pattern (No	ote 2)		N/A 01		01010101	N/A	01010101	
					01010101		01010101	
			0000	0100	01010101	00000100	01010101	
				0100 0100		00000100 00000100		
RLM/RRM Measu				0100	N/A	00000100		
Subframe Pattern	(Note 4)		0000	0100		00000100		
			0000	0100		00000100)	
				0101		01010101		
	0			0101	N1/A	01010101		
	Ccsi,0			0101 0101	N/A	01010101 01010101	-	
CSI Subframe Sets				0101		01010101		
(Note 3)				1010		10101010		
(11010-0)				1010		10101010		
	C _{CSI,1}			1010	N/A	10101010		
	,		1010	1010		10101010		
			1010	1010		10101010)	
Number of control symbols	Number of control OFDM symbols			3	}		3	
Max number of h transmission				1			1	
CQI delay		ms				1 3		
Reporting interval (ms				0		
Reporting mo						CH 3-0		
Sub-band siz		RB			6 (full			

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7]
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 are the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5
- Note 11: Reference measurement channel in Cell 1 RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 12: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 13: The CSI reporting is such that reference subframes belong to Ccsi.0.

Table 9.3.1.1.3-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
3	0.01	0.01
UE Category	≥1	≥1

9.3.1.1.4 TDD (CSI measurements in case two CSI subframe sets are configured and with CRS assistance information)

For the parameters specified in Table 9.3.1.1.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.4-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput in ABS subframes obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $> \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER in ABS subframes for the indicated transport formats shall be greater than or equal to ε .

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD.

Table 9.3.1.1.4-1: Sub-band test for single antenna transmission (TDD)

Parameter		Unit		Test 1		Test 2		
			Ce		Cell 2 and 3	Ce	II 1	Cell 2 and 3
Bandwidth		MHz		10			1	0
PDSCH transmission			1 Note 10				Note 10	
Uplink downlink con					1		•	1
Special subfra configuration				4	4		4	4
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0			()	
allocation	$ ho_{\scriptscriptstyle B}$	dB		()		()
	σ	dB		()		()
Propagation con	dition		Clause with Td us, a =	= 0.45 1, fd =	EVA5 Low antenna correlation	-	= 0.45 1, fd =	EVA5 Low antenna correlation
Antenna configu	ration				x2			x2
\widehat{E}_s/N_{oc2} (Not	e 1)	dB	4	5	Cell 2: 12 Cell 3: 10	14	15	Cell 2: 12 Cell 3: 10
(:)	$N_{oc1}^{(j)}$	dBm/15kHz	-98 (N	lote 7)	N/A	-98 (N	lote 7)	N/A
$N_{oc}^{(j)}$ at antenna	$N_{oc2}^{(j)}$	dBm/15kHz	-98 (Note 8)		N/A	-98 (Note 8)		N/A
port	$N_{oc3}^{(j)}$	dBm/15kHz	-93 (Note 9)		N/A	-93 (Note 9)		N/A
Subframe Configu	Subframe Configuration Non-MBSFN		IBSFN	Non-MBSFN	Non-MBSFN Non-MBS		Non-MBSFN	
Cell Id			()	Cell 2: 6 Cell 3: 1	0 Cell 2: 6 Cell 3: 1		Cell 2: 6 Cell 3: 1
Time Offset between	Time Offset between Cells		Cell 2: 3 usec Cell 3: -1usec				3 usec -1usec	
Frequency shift betw	een Cells	Hz	Cell 2: 300Hz Cell 3: -100Hz				300Hz	
ABS pattern (No	ote 2)		N.	/A	0100010001 0100010001		/A	0100010001 0100010001
RLM/RRM Measu Subframe Pattern (00000		N/A	00000		N/A
CSI Subframe Sets	Ccsi,0		01000 01000		N/A	01000 01000		N.A
(Note 3)	C _{CSI,1}			01000 01000	N/A		01000 01000	N/A
Number of control symbols	mber of control OFDM symbols		3		3			
Max number of HARQ transmissions				1	1		,	1
CQI delay		ms			1	0		
Reporting interval (Note 13)	ms			-	0		
Reporting mo						H 3-0		
Sub-band siz	_	RB			6 (full	size)		
ACK/NACK feedba	ck mode			Multip	lexing		Multip	lexing

- Note 1: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 2: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 3: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 4: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 5: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 6: Cell 1 is the serving cell. Cell 2 and Cell 3 are the aggressor cells. The number of the CRS ports in Cell1, Cell2, and Cell3 is the same.
- Note 7: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 8: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS
- Note 9: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS.
- Note 10: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5
- Note 11: Reference measurement channel in Cell 1 RC.3 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 12: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 13: The CSI reporting is such that reference subframes belong to Ccsi,0.

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
3	0.01	0.01
UE Category	≥1	≥1

Table 9.3.1.1.4-2 Minimum requirement (TDD)

9.3.1.1.5 TDD (when *csi-SubframeSet –r12* is configured)

The following requirements apply to UE Category ≥1 which supports Rel-12 CSI subframe sets. For the parameters specified in Table 9.3.1.1.5-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.1.5-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band for each CSI subframe set:
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be ≥ γ for each CSI subframe set;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05 and less than 0.60 for each CSI subframe set.
- d) the difference of the wide-band median CQI obtained by reports in CSI subframe sets $C_{CSI,0}$ and the wide-band median CQI obtained by reports in CSI subframe sets $C_{CSI,1}$ shall be larger than or equal to 3.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.1.5-1: Sub-band test for TDD

Parameter		Unit	Te	est	
Bandwidth		MHz		0	
	Transmission mode			2	
Uplink downlink c				2	
Special subframe				4	
CSI-MeasSubfran		ID.		00000	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-3		
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3		
	σ	dB		0	
SNR in CSI subfra		dB	0	1	
SNR in CSI subfra	ame set 1	dB	10	11	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-97	
$N_{oc1}^{(j)}$ for CSI subfr		dB[mW/15kHz]	-98	-98	
$N_{oc2}^{(j)}$ for CSI subfr	ame set 1	dB[mW/15kHz]	-108	-108	
Propagation chan	nel			th $\tau_d = 0.45 \mu\text{s}$, $\tau_D = 5 \text{Hz}$	
Antenna configura	ation		2:	$\frac{C_D}{D} = 5 \text{ Hz}$ x2	
CRS reference sign	gnals			ort 0 and 1	
Zero-Power CSI-F			3	3 /	
Icsi-RS / ZeroPower Zero-Power CSI-F				00000000	
I _{CSI-RS} / ZeroPowe	rCSI-RS bitmap		0100000000000000		
PDSCH schedule subframe set 0	d subframes for CSI		8,9		
PDSCH schedule	PDSCH scheduled subframes for CSI		3,4		
subframe set 1 Reporting interval (Note 4)		ms	10 per su	bframe set	
CQI delay			15 for CSI su	ubframe set 0 ubframe set 1	
Reporting mode			PUSCH 3-0		
Sub-band size		RB	6 (full size)		
	ARQ transmissions		1		
ACK/NACK feedb	ack mode		Multip	olexing	
Number of EPDC	CH Sets Configured		2 (No	te 5,6)	
Number of PRB p				4	
EPDCCH Subfrar				IA	
EPDCCH Aggreg				CCE	
EPDCCH beamfo				k B.4.4	
	E reports in an available				
	timation at a downlink su				
	band CQI cannot be app nce measurement chann		`	,	
Note 3: In the t					
Note 4: For CS					
	transmitted in downlink SF#3 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF #7. For CSI subframe set 1, PDCCH DCI format 0 with a trigger for aperiodic CQI				
shall be	shall be transmitted in downlink SF#8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2.				
Note 5: In case	·				
Note 6: The tw	sets are distributed EP	DCCH sets and non-o			
for the	first set and PRB = {40,	43, 46, 49} for the sec	ond set. EPDCCI	H set is selected	
after so	cheduling decision for PD	SCH to avoid collision	n between PDSCI	H and EPDCCH	
	respectively. EPDCCH is				
configu	CH is derived from the Po	JEICH. KKC signallin	g epacch-StartSyl	mboi-ra ais not	
Configu	ieu				

Table 9.3.1.1.5-2: Minimum requirement (TDD)

	Test
α[%]	2
β[%]	55
γ	1.1
UE Category	≥1

9.3.1.2 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

9.3.1.2.1 FDD

For the parameters specified in Table 9.3.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.1-1 Sub-band test for FDD

Parameter		Unit	Te	Test 1 Test 2		st 2
Bandwidth		MHz		10 MHz		
Transmission mode				9		
$ ho_{\scriptscriptstyle A}$		dB		0		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	P_{c}	dB		0		
	σ	dB			0	
SNR (Note 3)	dB	4	5	11	12
\hat{I}_{c}	(j) or	dB[mW/15kHz]	-94	-93	-87	-86
N	(j) oc	dB[mW/15kHz]	-9	98	-6	98
Dropogotic	on channel		Clause B.2.4 with $\tau_d=0.45\mu\mathrm{s},$			
Propagatio	on channel		$a = 1, f_D = 5 \text{ Hz}$			
Antenna configuration				2	x2	
Beamform	ning Model		As sp	As specified in Section B.4.3		B.4.3
CRS refere	nce signals			Antenna ports 0		
CSI refere	nce signals		Antenna ports 15, 16		16	
	and subframe offset			5,	/ 1	
	/ Acsi-RS				4	
	signal configuration				4)001	
	Restriction bitmap	ma				
Reporting interval (Note 4)		ms		<u>5</u> 8		
CQI delay		ms			o CH 3-1	
Reporting mode Sub-band size		RB				
Max number of HARQ transmissions		UD	 	o (iui	l size) 1	
						ed on
CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband						

or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Reference measurement channel RC.8 FDD according to Table A.4-1 with one/two Note 2: sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

For each test, the minimum requirements shall be fulfilled for at least one of the two Note 3: SNR(s) and the respective wanted signal input level.

Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Table 9.3.1.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	40	40
γ	1.1	1.1
UE Category	≥1	≥1

9.3.1.2.2 **TDD**

For the parameters specified in Table 9.3.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;

c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.2-1 Sub-band test for TDD

Parameter		Unit	Te	Test 1 Test 2		st 2
Bandwidth		MHz		10 MHz		
Transmission mode				!	9	
Uplink downlin	k configuration				2	
Special subfran	ne configuration				4	
	$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0		
allocation	P_c	dB	0			
	σ	dB			0	
SNR (I	Note 3)	dB	4	5	11	12
\hat{I}_{c}	(j) or	dB[mW/15kHz]	-94	-93	-87	-86
N	(j) oc	dB[mW/15kHz]	-(98	-6	98
			Clause	B.2.4 wi	th $\tau_d = 0$).45 <i>μ</i> s,
Propagation	on channel			$a = 1, f_D = 5 \text{ Hz}$		
Antenna co	onfiguration		2x2			
	ning Model		As sp	As specified in Section B.4.3		
CRS refere	nce signals			Antenn	a port 0	
CSI reference signals				Antenna	port 15,1	6
CSI-RS periodicity	and subframe offset			5	/ 3	
	$/\Delta_{ exttt{CSI-RS}}$			5,	7 3	
CSI-RS reference :	signal configuration				4	
CodeBookSubset	Restriction bitmap			000001		
Reporting into	erval (Note 4)	ms	5			
CQI	delay	ms		10		
Reportir	ng mode			PUSC	CH 3-1	
Sub-ba	nd size	RB		6 (ful	l size)	
Max number of HA	ARQ transmissions				1	
ACK/NACK fe	edback mode			Multip	lexing	
Note 1: If the UE	reports in an available	uplink reporting insta	nce at su	ubframe \$	SF#n bas	ed on
CQI estim	CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband					bband
or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)						
Note 2: Reference measurement channel RC.8 TDD according to Table A.4-1 with one/two				'two		
sided dyn	sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.					
	For each test, the minimum requirements shall be fulfilled for at least one of the two			two		
	SNR(s) and the respective wanted signal input level.					
SF#3 and #8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2 and #7.			ıd #7.			

Table 9.3.1.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	2	2
β[%]	40	40
γ	1.1	1.1
UE Category	≥1	≥1

Test 1

As specified in Section B.4.3

Antenna ports 0

Antenna ports 15, 16

5/1

000001

5

8

PUSCH 3-1

6 (full size)

Parameter

Beamforming Model

CRS reference signals

CSI reference signals

CSI-RS periodicity and subframe offset

T_{CSI-RS} / ∆_{CSI-RS}

CSI-RS reference signal configuration

CodeBookSubsetRestriction bitmap

Reporting interval (Note 4)

CQI delay

Reporting mode

Sub-band size

Max number of HARQ transmissions

9.3.1.2.3 FDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

For the parameters specified in Table 9.3.1.2.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.3-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Bandwidth 10 MHz MHz Transmission mode 9 0 dB $\rho_{\scriptscriptstyle A}$ dΒ 0 Downlink power $\rho_{\scriptscriptstyle B}$ allocation P_c dΒ 0 dB 0 σ SNR (Note 3) dB 16 17 $\hat{I}_{or}^{(j)}$ dB[mW/15kHz] -82 -81 $N_{oc}^{(j)}$ dB[mW/15kHz] -98 -98 Clause B.2.4 with $\tau_{_d}=0.45\,\mu\mathrm{s}$, Propagation channel a = 1, $f_D = 5 \text{ Hz}$ Antenna configuration 2x2

Table 9.3.1.2.3-1 Sub-band test for FDD

Unit

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

ms

ms

RB

- Note 2: Reference measurement channel RC.8A FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Table 9.3.1.2.3-2 Minimum requirement (FDD)

	Test 1
α[%]	2
β[%]	40
γ	1.1
UE Category	11-12
UE DL Category	<u>≥</u> 11

9.3.1.2.4 TDD (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

For the parameters specified in Table 9.3.1.2.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.4-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

In this test, 4-bit CQI Table 2 in Table 7.2.3-2 in TS 36.213 [6], and Modulation and TBS index table 2 in Table 7.1.7.1-1A for PDSCH in TS 36.213 [6] are applied.

Table 9.3.1.2.4-1 Sub-band test for TDD

Parai	meter	Unit	Test 1
Band	width	MHz	20 MHz
Transmiss	sion mode		9
Uplink downlin	k configuration		2
Special subframe configuration			4
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0
	P_{c}	dB	0
	σ	dB	0

SNR (Note 3)	dB	16	17
$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-82	-81
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98
Decreasion showed		Clause B.2.4 wi	th $\tau_d = 0.45 \mu\text{s}$,
Propagation channel		$a = 1, f_D = 5 \text{ Hz}$	
Antenna configuration			x2
Beamforming Model		As specified in Section B.4.3	
CRS reference signals		Antenna port 0	
CSI reference signals		Antenna port 15,16	
CSI-RS periodicity and subframe offset TCSI-RS / \(\Delta \text{CSI-RS} \)		5/ 3	
CSI-RS reference signal configuration		4	
CodeBookSubsetRestriction bitmap		000001	
Reporting interval (Note 4)	ms	5	
CQI delay	ms	10	
Reporting mode		PUSCH 3-1	
Sub-band size	RB	8 (full size)	
Max number of HARQ transmissions		1	
ACK/NACK feedback mode	ick mode Multiplexing		lexing

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- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.8A TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3 and #8 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#2 and #7.

Table 9.3.1.2.4-2 Minimum requirement (TDD)

	Test 1
<i>α</i> [%]	2
β [%]	40
γ	1.1
UE Category	11-12
UE DL Category	≥11

9.3.1.2.5 Void

Table 9.3.1.2.5-1: Void

Table 9.3.1.2.5-2: Void

9.3.1.2.6 TDD (when *csi-SubframeSet –r12* is configured with one CSI process)

The following requirements apply to UE Category ≥1 which supports Rel-12 CSI subframe sets and TM10. For the parameters specified in Table 9.3.1.2.6-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.1.2.6-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band for each CSI subframe set;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the

TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be $\geq \gamma$ for each CSI subframe set;

- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.01 for each CSI subframe set.
- d) The difference of the wide-band median CQI obtained by reports in CSI subframe sets $C_{CSI,0}$ and the wide-band median CQI obtained by reports in CSI subframe sets $C_{CSI,1}$ shall be larger than or equal to 3.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.1.2.6-1: Sub-band test for TDD

Parai	meter	Unit	Te	est
Bandwidth		MHz	10	
Transmission mode			1	0
Uplink downlink configuration			2	2
Special subfran	Special subframe configuration		4	4
CSI-MeasSub	oframeSet-r12		00011	00000
	$ ho_{\scriptscriptstyle A}$	dB	(0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	(0
allocation	P_c	dB	_	3
	σ	dB		3
SNR in CSI s		dB	0	1
SNR in CSI s		dB	10	11
	(j) or	dB[mW/15kHz]	-98	-97
	subframe set 0	dB[mW/15kHz]	-98	-98
	subframe set 1	dB[mW/15kHz]	-108	-108
TV _{oc2} IOI CSI	Subitatile Set 1	ub[iiivv/15ki iz]		
Propagation				th $\tau_d = 0.45 \mu\text{s}$, $\tau_D = 5 \text{Hz}$
Antenna co				
	ning Model			Section B.4.3
CRS refere				ort 0 and 1
CSI refere			Antenna	port 15,16
CSI-RS periodicity	and subtrame offset $^{\prime}$ $\Delta_{ exttt{CSI-RS}}$		5/	0
CSI-RS reference			0	
Zero-Power CSI-F			3 /	
	erCSI-RS bitmap		0000010000000000	
Zero-Power CSI-F			4 /	
Icsi-Rs / ZeroPow	<i>erCSI-RS</i> bitmap		010000000000000	
	erCSI-RS bitmap	3 / 00000100000000		•
CSI-IM con I _{CSI-RS} / ZeroPow	figuration 1 erCSI-RS bitmap		01000000	. / 000000000
CSI process configuration Signal/Interference/CSI subfr	Reporting mode for		CSI-RS/CSI-IM 0/PUSCH 3-1	
CSI process configu	ration Reporting mode for		CSI-RS/CSI-IN	1 1/PUSCH 3-1
	Restriction bitmap		000	001
Reporting into		ms		oframe set
	delay	ms	15 for CSI su	ubframe set 0
				ubframe set 1
Sub-ba		RB	6 (ful	l size)
PDSCH scheduled subfran	subframes for CSI		8	,9
PDSCH scheduled subframes for CSI		,4		
Max number of HA			,	1
ACK/NACK fe				lexing
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subbanc or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)				
sided dyn	sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.			
	Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two			
SNR(s) and the respective wanted signal input level for each subframe set separately. Note 4: For CSI subframe set 0, PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3 to allow aperiodic CQI/PMI/RI to be transmitted on uplink				
SF #7. For CSI subframe set 1, PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#8 to allow aperiodic CQI/PMI/RI to be transmitted				

on uplink SF#2.

Table 9.3.1.2.6-2: Minimum requirement (TDD)

	Test
α[%]	2
β[%]	55
γ	1.02
UE Category	≥1

9.3.2 Frequency non-selective scheduling mode

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective fading conditions is determined by the reporting variance, and the relative increase of the throughput obtained when the transport format transmitted is that indicated by the reported CQI compared to the case for which a fixed transport format configured according to the reported median CQI is transmitted. In addition, the reporting accuracy is determined by a minimum BLER using the transport formats indicated by the reported CQI. The purpose is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for frequently non-selective scheduling. To account for sensitivity of the input SNR the CQI reporting under frequency non-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

9.3.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

9.3.2.1.1 FDD

For the parameters specified in Table 9.3.2.1.1-1 and Table 9.3.2.1.1-3, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.1-2 and Table 9.3.2.1.1-4 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02

The applicability of the requirement with 5MHz bandwidth as specificed in Table 9.3.2.1.1-3 and Table 9.3.2.1.1-4 is defined in 9.1.1.1.

Table 9.3.2.1.1-1 Fading test for single antenna (FDD)

Parameter		Unit	Te	Test 1 Test 2			
Bandwidth		MHz	10 MHz				
Transmiss	sion mode			1 (po	ort 0)		
Downlink	$ ho_{\scriptscriptstyle A}$	dB		0			
power	$ ho_{\scriptscriptstyle B}$	dB		()		
allocation	σ	dB		()		
SNR (N	Note 3)	dB	6	7	12	13	
- 0	j) r	dB[mW/15kHz]	-92	-91	-86	-85	
N_{c}	(j) oc	dB[mW/15kHz]	-98 -9		98		
Propagation	n channel		EPA5				
Correlat			High (1 x 2)				
antenna co	nfiguration						
Reportin			PUCCH 1-0				
Reporting	periodicity	ms		$N_{pd} = 2$			
CQI	delay	ms		8			
	hannel for		DUSCH (Note 4)				
CQI reporting				PUSCH (Note 4)			
PUCCH Report Type				4			
cqi-pmi- ConfigurationIndex					1		
Max number of HARQ transmissions				1			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.

Table 9.3.2.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥1	≥1

Table 9.3.2.1.1-3 Fading test for single antenna (FDD)

Parameter		Unit	Test 1		Tes	est 2	
Bandwidth		MHz	5 MHz				
Transmission mode			1 (port 0)				
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0				
power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	σ	dB	0				
SNR (Note 3)		dB	6	7	12	13	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-92	-91	-86	-85	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98		
Propagation channel			EPA5				
Correlation and			High (1 x 2)				
antenna configuration			• , ,				
Reporting mode			PUCCH 1-0				
Reporting periodicity		ms	$N_{pd} = 2$				
CQI delay		ms	8				
Physical channel for			PUSCH (Note 4)				
CQI reporting			` ,				
PUCCH Report Type			4				
cqi-pmi- ConfigurationIndex			1				
Max number of HARQ			1				
transmissions							
 Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4) Note 2: Reference measurement channel RC.14 FDD according to Table A.4-1 for Category ≥ 2 with one sided dynamic OCNG Pattern OP.1 							
FDD as described in Annex A.5.1.1 and RC.15 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.Note 3: For							

one of the two SNR(s) and the respective wanted signal input level.

Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.

each test, the minimum requirements shall be fulfilled for at least

Table 9.3.2.1.1-4 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥1	≥1

9.3.2.1.2 TDD

For the parameters specified in Table 9.3.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.1.2-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.1.2-1 Fading test for single antenna (TDD)

Parameter		Unit	Tes	st 1	Tes	st 2
Bandwidth		MHz	10 MHz			
Transmission mode			1 (port 0)			
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	σ	dB	0			
Uplink downlink configuration			2			
Special subframe configuration			4			
SNR (I	Note 3)	dB	6	7	12	13
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-92	-91	-86	-85
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98	
Propagation channel			EPA5			
Correlation and antenna configuration			High (1 x 2)			
Reporting mode			PUCCH 1-0			
Reporting periodicity		ms	$N_{\rm pd} = 5$			
CQI delay		ms	10 or 11			
Physical channel for CQI reporting			PUSCH (Note 4)			
PUCCH Report Type			4			
cqi-pmi- ConfigurationIndex			3			
Max number of HARQ transmissions			1			
ACK/NACK feedback mode			Multiplexing			
Note 1:	f the UE repo	rts in an available u	plink rep	orting ins	tance at	

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.1 TDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and RC.4 TDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

Table 9.3.2.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥1	≥1

9.3.2.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

9.3.2.2.1 FDD

For the parameters specified in Table 9.3.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.1-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time:
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.2.1-1 Fading test for FDD

Parameter		Unit	Tes	Test 1 Test 2		st 2	
Band	width	MHz		10 MHz			
Transmiss	sion mode			Ç	9		
	$ ho_{\scriptscriptstyle A}$	dB		()		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	P_c	dB		-	3		
	σ	dB		-	3		
SNR (I	Note 3)	dB	2	3	7	8	
\hat{I}_{a}^{i}	(j) or	dB[mW/15kHz]	-96	-95	-91	-90	
N_{i}	(j) oc	dB[mW/15kHz]	-6	98	-98 A5 h (4 x 2)		
Propagation channel				EPA5			
Correlation and antenna configuration			ULA High (4 x 2)				
Beamforming Model			As sp	As specified in Section B.4.3			
Cell-specific reference signals				Antenna	ports 0,1		
CSI reference signals			An	tenna po	rts 15,	18	
	and subframe offset $/$ $\Delta_{ ext{CSI-RS}}$			5	/1		
	signal configuration				2		
	CodeBookSubsetRestriction bitmap		0x0	000 000	0 0000 0	001	
Reportir	ng mode			PUCC	H 1-1		
Reporting	periodicity	ms		$N_{pd} = 5$			
CQI delay		ms	8				
Physical channel for CQI/ PMI reporting				PUSCH	(Note 4)		
PUCCH Report Type for CQI/PMI				2	2		
PUCCH channel for RI reporting				PUCCH	Format 2		
PUCCH report type for RI				(3		
cqi-pmi-Confi	gurationIndex			- 2	2		
	igIndex				1		
Max number of HA			,	1			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.

Table 9.3.2.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥2	≥2

9.3.2.2.2 TDD

For the parameters specified in Table 9.3.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.2.2.2-2 and by the following

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

Table 9.3.2.2.1 Fading test for TDD

Parameter		Unit	Tes	Test 1 Test 2		st 2
Band	width	MHz		10 N	ИHz	
Transmiss	sion mode			ę	9	
Uplink downlin	k configuration				2	
Special subframe configuration				4	1	
	$ ho_{\scriptscriptstyle A}$	dB		()	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	P_{c}	dB		-(6	
	σ	dB		-;	3	
SNR (I	Note 3)	dB	1	2	7	8
\hat{I}_{a}^{\prime}	(j) or	dB[mW/15kHz]	-97	-96	-91	-90
N	(j) oc	dB[mW/15kHz]	-9	8	-9	8
Propagation channel				EPA5		
Correlation and antenna configuration			XP High (8 x 2)			
Beamforming Model			As sp	As specified in Section B.4.3		
CRS reference signals				Antenna ports 0, 1		
CSI reference signals			An	Antenna ports 15,,22		
CSI-RS periodicity	and subframe offset			5/	2	
T _{CSI-RS}	$/\Delta_{ extsf{CSI-RS}}$			3/	3	
CSI-RS reference signal configuration				2	2	
CodeBookSubsetRestriction bitmap			0x000	0 0000 0 0000		0000
Reportir	ng mode		PUC	CH 1-1 (Sub-mod	e: 2)
Reporting	periodicity	ms		$N_{pd} = 5$		
	delay	ms		10		
Physical channel for CQI/ PMI				DIICCH	(Note 4)	
reporting				PUSCH (Note 4)		
PUCCH Report Type for CQI/ PMI					С	
Physical channel for RI reporting				PUCCH	Format 2	
PUCCH report type for RI					3	
cqi-pmi-ConfigurationIndex				3		
	igIndex			805 (N	lote 5)	
Max number of HA	ARQ transmissions					
ACK/NACK fe	edback mode			Multip	lexing	

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.
- Note 5: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.

Table 9.3.2.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05
UE Category	≥2	≥2

9.3.3 Frequency-selective interference

The accuracy of sub-band channel quality indicator (CQI) reporting under frequency selective interference conditions is determined by a percentile of the reported differential CQI offset level +2 for a preferred sub-band, and the relative increase of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level the corresponding transport format compared to the case for which a fixed format is transmitted on any sub-band in set *S* of TS 36.213 [6]. The purpose is to verify that preferred sub-bands are used for frequently-selective scheduling under frequency-selective interference conditions.

9.3.3.1 Minimum requirement PUSCH 3-0 (Cell-Specific Reference Symbol)

9.3.3.1.1 FDD

For the parameters specified in Table 9.3.3.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.1-2 and by the following

- a) a sub-band differential CQI offset level of +2 shall be reported at least α % for at least one of the sub-bands of full size at the channel edges;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.3.1.1-1 Sub-band test for single antenna transmission (FDD)

Parai	neter	Unit	Test 1	Test 2
Bandwidth		MHz	10 MHz	10 MHz
Transmission mode			1 (port 0)	1 (port 0)
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0
power	$ ho_{\scriptscriptstyle B}$	dB	0	0
allocation	σ	dB	0	0
$I_{ot}^{(j)}$ for	RB 05	dB[mW/15kHz]	-102	-93
$I_{ot}^{(j)}$ for F	RB 641	dB[mW/15kHz]	-93 -93	
$I_{ot}^{(j)}$ for R	B 4249	dB[mW/15kHz]	-93	-102
\hat{I}_{c}^{0}	(j) or	dB[mW/15kHz]	-94 -94	
	er of HARQ issions		1	
			Clause B.2.4 wi	th $\tau_d = 0.45 \mu\text{s}$,
Propagation	on channel			$T_D = 5 \mathrm{Hz}$
Reportin	g interval	ms		5
Antenna co	onfiguration		1:	x 2
	delay	ms		8
	ng mode			CH 3-0
Sub-ba	nd size	RB	6 (full size)	

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.3 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Table 9.3.3.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α[%]	60	60
γ	1.6	1.6
UE Category	≥1	≥1

9.3.3.1.2 TDD

For the parameters specified in Table 9.3.3.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.3.1.2-2 and by the following

- a) a sub-band differential CQI offset level of +2 shall be reported at least $\alpha\%$ for at least one of the sub-bands of full size at the channel edges;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.3.1.2-1 Sub-band test for single antenna transmission (TDD)

Parar	neter	Unit	Test 1	Test 2
Band	width	MHz	10 MHz	10 MHz
Transmiss	sion mode		1 (port 0)	1 (port 0)
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0	0
power	$ ho_{\scriptscriptstyle B}$	dB	0	0
allocation	σ	dB	0	0
	lownlink uration		2	
	subframe uration		4	
$I_{ot}^{(j)}$ for	RB 05	dB[mW/15kHz]	-102	-93
$I_{ot}^{(j)}$ for F	RB 641	dB[mW/15kHz]	-93 -93	
$I_{ot}^{(j)}$ for R	B 4249	dB[mW/15kHz]	-93 -102	
\hat{I}_o^{\prime}	(j) or	dB[mW/15kHz]	-94	-94
Max number transm	er of HARQ issions		1	
			Clause B.2.4 with	h $\tau_{_d} = 0.45 \mu \text{s},$
Propagation	on channel		$a = 1, f_I$	
Antenna co	onfiguration		1 x 2	
Reporting	g interval	ms	5	
	delay	ms	10 or 11	
Reporting mode			PUSC	H 3-0
Sub-band size		RB	6 (full	size)
mo			Multipl	
Note 1: If the UE reports in an available uplink reporting instance at				

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.3 TDD according to table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.

Table 9.3.3.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	60	60
γ	1.6	1.6
UE Category	≥1	≥1

9.3.3.2 Void

9.3.3.2.1 Void

9.3.3.2.2 Void

9.3.4 UE-selected subband CQI

The accuracy of UE-selected subband channel quality indicator (CQI) reporting under frequency-selective fading conditions is determined by the relative increase of the throughput obtained when transmitting on the UE-selected subbands with the corresponding transport format compared to the case for which a fixed format is transmitted on any subband in set *S* of TS 36.213 [6]. The purpose is to verify that correct subbands are accurately reported for frequency-selective scheduling. To account for sensitivity of the input SNR the subband CQI reporting under frequency-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

9.3.4.1 Minimum requirement PUSCH 2-0 (Cell-Specific Reference Symbols)

9.3.4.1.1 FDD

For the parameters specified in Table 9.3.4.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband COI median on a randomly selected subband in set S shall be $\geq \gamma$;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the $N_{\rm PRB}$ entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.1.1-1 Subband test for single antenna transmission (FDD)

Para	meter	Unit	Tes	st 1	Tes	st 2
Band	dwidth	MHz		10 N	ИНz	
Transmis	sion mode			1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB		()	
power	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	σ	dB		()	
SNR (Note 3)	dB	9	10	14	15
	(j) or	dB[mW/15kHz]	-89	-88	-84	-83
N	r(j) oc	dB[mW/15kHz]	-6	98	-6	98
			Clause	B.2.4 wit	th $\tau_d = 0$).45 <i>μ</i> s,
Propagati	on channel					•
			$a = 1, f_D = 5 \text{ Hz}$			
	g interval	ms	<u>5</u>			
	delay	ms	PUSCH 2-0			
	ng mode er of HARQ			PUSC	,⊓ Z-U	
	nissions		1			
	d size (k)	RBs	3 (full size)			
	of preferred	1,120		,		
	nds (M)			,	5	
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)						
Note 2:	Note 2: Reference measurement channel RC.5 FDD according to Table					
	A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as					D as
	described in Annex A.5.1.1/2. Note 3: For each test, the minimum requirements shall be fulfilled for at					
	east one of the	ne two SNR(s) and t	ne respe	cuve war	iteu signa	ai iriput
ievei.						

Table 9.3.4.1.1-2 Minimum requirement (FDD)

	Test 1	Test 2
γ	1.2	1.2
UE Category	≥1	≥1

9.3.4.1.2 TDD

For the parameters specified in Table 9.3.4.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on a randomly selected subband among the best M subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be $\geq \gamma$;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the N_{PRB} entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.1.2-1 Sub-band test for single antenna transmission (TDD)

Parai	meter	Unit	Tes	st 1	Tes	st 2
Band	width	MHz		10 l	ИНz	
Transmiss	sion mode			1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB		()	
power	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	σ	dB		()	
	lownlink uration			2	2	
	subframe uration			4	1	
SNR (Note 3)	dB	9	10	14	15
\hat{I}_{a}^{c}	(j) or	dB[mW/15kHz]	-89	-88	-84	-83
N	(j) oc	dB[mW/15kHz]	-6	98	-6	98
			Clause B.2.4 with $\tau_d = 0.45 \mu$		$0.45 \mu s$,	
Propagation	on channel		· ·		,	
Reportin	g interval	ms	$a = 1, f_D = 5 \text{ Hz}$			
	delay	ms	10 or 11			
	ng mode			PUSC	H 2-0	
	er of HARQ				1	
	issions				•	
	d size (k)	RBs		3 (full	size)	
	f preferred				5	
	nds (M)					
	K feedback ode			Multip	lexing	
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4) Note 2: Reference measurement channel RC.5 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as						
Note 3: F	described in Annex A.5.2.1/2. Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.					

Table 9.3.4.1.2-2 Minimum requirement (TDD)

	Test 1	Test 2
γ	1.2	1.2
UE Category	≥1	≥1

9.3.4.2 Minimum requirement PUCCH 2-0 (Cell-Specific Reference Symbols)

9.3.4.2.1 FDD

For the parameters specified in Table 9.3.4.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be $\geq \gamma$;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each TTI for FDD. The transport block size TBS (wideband CQI median) is that resulting

from the code rate which is closest to that indicated by the wideband CQI median and the $N_{\rm PRB}$ entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.2.1-1 Subband test for single antenna transmission (FDD)

Parameter		Unit	Te	st 1	Tes	st 2
Bandwidth		MHz			ИHz	
Transmission mode				1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power	$ ho_{\scriptscriptstyle B}$	dB		()	
allocation	σ	dB		()	
SNR	(Note 3)	dB	8	9	13	14
	$\hat{I}_{or}^{(j)}$	dB[mW/15kHz]	-90	-89	-85	-84
1	$V_{oc}^{(j)}$	dB[mW/15kHz]	-(98	-9	8
			Clause	B.2.4 wit	th $\tau_{J} = 0$	$.45 \mu$ s,
Propaga	tion channel			a = 1, f		,
Reportin	g periodicity	ms			= 2	
CQ	l delay	ms			3	
	channel for		PUSCH (Note 4)			
CQI reporting				FUSCII	(INOIE 4)	
PUCCH Report Type				2	1	
for wideband CQI					•	
	Report Type		1			
	band CQI ber of HARQ					
	missions			1	1	
	nd size (<i>k</i>)	RBs	6 (full size)			
	of bandwidth	TAD3				
	rts (<i>J</i>)			3	3	
	K			•	1	
cqi-pmi-	ConfigIndex				1	
Note 1:	If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)					
Note 2:	Reference me A.4-1 with one described in A	rence measurement channel RC.3 FDD according to Table with one/two sided dynamic OCNG Pattern OP.1/2 FDD as ibed in Annex A.5.1.1/2.				
Note 3:	least one of the level.	est, the minimum requirements shall be fulfilled for at fifthe two SNR(s) and the respective wanted signal input			ıl input	
Note 4:		avoid collisions between CQI reports and HARQ-ACK it is essary to report both on PUSCH instead of PUCCH.				

bandwidth part) are to be disregarded and data scheduling according to the most recent subband CQI report for bandwidth part

in uplink subframe SF#5, #7, #1 and #3. CQI reports for the short subband (having 2RBs in the last

DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH

Note 5:

Note 6: In the case where wideband CQI is reported, data is to be scheduled according to the most recently used subband CQI report.

Table 9.3.4.2.1-2 Minimum requirement (FDD)

	Test 1	Test 2
γ	1.15	1.15
UE Category	≥1	≥1

9.3.4.2.2 TDD

For the parameters specified in Table 9.3.4.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.4.2.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on subbands reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected subband in set S shall be $\geq \gamma$;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new subband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the N_{PRB} entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the subband size.

Table 9.3.4.2.2-1 Sub-band test for single antenna transmission (TDD)

Parameter		Unit	Te	st 1	Tes	st 2
	dwidth	MHz	10 MHz			
Transmis	sion mode			1 (po	ort 0)	
Downlink	$ ho_{\scriptscriptstyle A}$	dB	0			
power allocation	$ ho_{\scriptscriptstyle B}$	dB	0			
	σ	dB		()	
Uplink downlink configuration				2	2	
	subframe guration			4	1	
	(Note 3)	dB	8	9	13	14
	F(j) or	dB[mW/15kHz]	-90	-89	-85	-84
	$I_{oc}^{(j)}$	dB[mW/15kHz]	-(98	-9	18
Dropogati	ion channal		Clause	B.2.4 wit	th $\tau_d = 0$.45 μs,
Propagati	ion channel			a = 1, f	$_D = 5 \mathrm{Hz}$	
Reporting	periodicity	ms		N _P	= 5	
	delay	ms		10 c	or 11	
	channel for eporting			PUSCH	(Note 4)	
PUCCH F	Report Type			4	1	
	band CQI Report Type					
	oand CQI			•	1	
	er of HARQ				I	
	nissions Id size (<i>k</i>)	RBs		6 (full	cizo)	
	f bandwidth	IVD9		•	•	
	ts (<i>J</i>)				3	
	K					
	ConfigIndex K feedback			- 3	3	
	ode			Multip	lexing	
		rts in an available u				
		‡n based on CQI es SF#(n-4), this repor				
		blied at the eNB dov				JQI
		easurement channe				able
		e/two sided dynamic	OCNG	Pattern C	P.1/2 TD	D as
		Annex A.5.2.1/2. the minimum requi	romonte	chall he f	ulfillad for	r at
		ne two SNR(s) and t				
	level.	(0)				
		sions between CQI				
	•	report both on PUS shall be transmitted				
		o multiplex with the				
	subframe SF#					•
Note 5: CQI reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and data scheduling						
		n) are to be disrega he most recent subl				dth nart
	with j=1.	no moot roodiit aubi	Jana OQ	. roport it	Sanawi	an part
Note 6:	In the case wh	where wideband CQI is reported, data is to be				
		cording to the most	recently	used sub	band CQ	l
	report.					

Table 9.3.4.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
γ	1.15	1.15
UE Category	≥1	≥1

9.3.5 Additional requirements for enhanced receiver Type A

The purpose of the test is to verify that the reporting of the channel quality is based on the receiver of the enhanced Type A. Performance requirements are specified in terms of the relative increase of the throughput obtained when the transport format is that indicated by the reported CQI subject to an interference model compared to the case with a white Gaussian noise model, and a requirement on the minimum BLER of the transmitted transport formats indicated by the reported CQI subject to an interference model.

9.3.5.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol)

9.3.5.1.1 FDD

For the parameters specified in Table 9.3.5.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.1.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be $\geq \gamma$;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.1.1-1 Fading test for single antenna (FDD)

Par	ameter	Unit	Cell 1	Cell 2
Baı	ndwidth	MHz		MHz
	ission mode			ort 0)
	lic Prefix		Normal	Normal
	cell ID		0	1
	R (Note 8)	dB	-2	N/A
	$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A
	tion channel		EPA5	Static (Note 7)
antenna	lation and configuration		Low (1 x 2)	(1 x 2)
	(Note 4)	dB	N/A	-0.41
	ference ment channel		Note 2	R.2 FDD
	ting mode		PUCCH 1-0	N/A
	ng periodicity	ms	$N_{pd} = 2$	N/A
CC	l delay	ms	8	N/A
CQI	I channel for reporting		PUSCH (Note 3)	N/A
	Report Type		4	N/A
Configu	qi-pmi- urationIndex		1	N/A
	ber of HARQ missions		1	N/A
Note 1: Note 2: Note 3:	subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4) Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2. To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3. The respective received power spectral density of each interfering			
Note 5: Note 6: Note 7:	cell relative to N_{oc} is defined by its associated DIP value as specified in clause B.5.1. Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded. Both cells are time-synchronous. Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.			

Table 9.3.5.1.1-2 Minimum requirement (FDD)

SINR corresponds to \hat{E}_{s}/N_{oc} of Cell 1 as defined in clause

γ	1.8
UE Category	≥1

9.3.5.1.2 TDD

Note 8:

For the parameters specified in Table 9.3.5.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.1.2-2 and by the following

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be $\geq \gamma$;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.1.2-1 Fading test for single antenna (TDD)

Parameter	Unit	Cell 1	Cell 2
Bandwidth	MHz	10 MHz	
Transmission mode		1 (port 0)	
Uplink downlink		2	
configuration		<u> </u>	
Special subframe			4
configuration			·
Cyclic Prefix		Normal	Normal
Cell ID		0	1
SINR (Note 8)	dB	-2	N/A
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98
Propagation channel		EPA5	Static (Note 7)
Correlation and antenna configuration		Low (1 x 2)	(1 x 2)
DIP (Note 4)	dB	N/A	-0.41
Reference		Note 2	R.2A TDD
measurement channel			
Reporting mode		PUCCH 1-0	N/A
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A
CQI delay	ms	10 or 11	N/A
Physical channel for CQI reporting		PUSCH (Note 3)	N/A
PUCCH Report Type		4	N/A
cqi-pmi- ConfigurationIndex		3	N/A
Max number of HARQ transmissions		1	N/A
ACK/NACK feedback mode	wto in an available .	Multiplexing	N/A

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.1 TDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and RC.4 TDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: The respective received power spectral density of each interfering cell relative to N_{oc} ' is defined by its associated DIP value as specified in clause B.5.1.
- Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.
- Note 6: Both cells are time-synchronous.
- Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.
- Note 8: SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Table 9.3.5.1.2-2 Minimum requirement (TDD)

γ	1.8
UE Category	≥1

9.3.5.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

9.3.5.2.1 FDD

For the parameters specified in Table 9.3.5.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.5.2.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be $\geq \gamma$;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.2.1-1 Fading test for two antennas (FDD)

Parameter	Unit	Cell 1	Cell 2
Bandwidth	MHz	10	MHz
Transmission mode			9
Cyclic Prefix		Normal	Normal
Cell ID		0	1
SINR (Note 8)	dB	-2	N/A
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A
Propagation channel		EPA5	Static (Note 7)
Correlation and antenna configuration		Low (2 x 2)	(1 x 2)
Beamforming Model		As specified in Section B.4.3 (Note 10, 11)	N/A
DIP (Note 4)	dB	N/A	-0.41
Cell-specific reference signals		Antenna ports 0,1	Antenna port 0
CSI reference signals		Antenna ports 15,16	N/A
CSI-RS periodicity and subframe offset		5/1	N/A
CSI-RS reference signal configuration		2	N/A
Zero-power CSI-RS configuration IcsI-RS / ZeroPowerCSI-RS bitmap	Subframes / bitmap	N/A	1 / 001000000000 000
CodeBookSubsetRestr iction bitmap		001111	N/A
Reference measurement channel		Note 2	R.2 FDD
Reporting mode		PUCCH 1-1	N/A
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A
CQI delay	ms	8	N/A
Physical channel for CQI/PMI reporting		PUSCH (Note 3)	N/A
PUCCH Report Type for CQI/PMI		2	N/A
PUCCH channel for RI reporting		PUCCH Format 2	N/A
PUCCH Report Type for RI		3	N/A
cqi-pmi- ConfigurationIndex		2	N/A
ri-ConfigIndex		1	N/A
Max number of HARQ transmissions		1	N/A

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.

Note 4: The respective received power spectral density of each interfering cell relative to N_{oc} ' is defined by its associated DIP value as specified in clause B.5.1.

Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.

Note 6:	Both cells are time-synchronous.
Note 7:	Static channel is used for the interference model. In case for white
	Gaussian noise model Cell 2 is not present.
Note 8:	SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause
	8.1.1.
Note 9:	N/A.
Note 10:	The precoder in clause B.4.3 follows UE recommended PMI.
Note 11:	If the UE reports in an available uplink reporting instance at
	subrame SF#n based on PMI estimation at a downlink SF not later
	than SF#(n-4), this reported PMI cannot be applied at the eNB
	downlink before SF#(n+4).

Table 9.3.5.2.1-2 Minimum requirement (FDD)

γ	1.8
UE Category	≥2

9.3.5.2.2 TDD

For the parameters specified in Table 9.3.5.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.5.2.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be $\geq \gamma$;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.3.5.2.2-1 Fading test for single antenna (TDD)

Parameter	Unit	Cell 1	Cell 2
Bandwidth	MHz	10 I	MHz
Transmission mode		,	9
Uplink downlink			2
configuration		2	
Special subframe		4	
configuration			-
Cyclic Prefix		Normal	Normal
Cell ID		0	1
SINR (Note 8)	dB	-2	N/A
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98
Propagation channel		EPA5	Static (Note 7)
Correlation and		Low (2 x 2)	(1 x 2)
antenna configuration		-	
Beamforming Model		As specified in Section B.4.3 (Note 11, 12)	N/A
DIP (Note 4)	dB	N/A	-0.41
Cell-specific reference signals		Antenna ports 0,1	Antenna port 0
CSI reference signals		Antenna ports 15,16	N/A
CSI-RS periodicity and subframe offset		5/3	N/A
CSI-RS reference signal configuration		2	N/A
Zero-power CSI-RS configuration Icsi-RS / ZeroPowerCSI-RS bitmap	Subframes / bitmap	N/A	3 / 001000000000 0000
CodeBookSubsetRestr iction bitmap		001111	N/A
Reference measurement channel		Note 2	R.2A TDD
Reporting mode		PUCCH 1-1	N/A
Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A
CQI delay	ms	10	N/A
Physical channel for CQI/PMI reporting		PUSCH (Note 3)	N/A
PUCCH Report Type for CQI/PMI		2	N/A
Physical channel for RI reporting		PUCCH Format 2	N/A
PUCCH Report Type for RI		3	N/A
cqi-pmi- ConfigurationIndex		3	N/A
ri-ConfigIndex		805 (Note 9)	N/A
Max number of HARQ transmissions		1	N/A
ACK/NACK feedback mode		Multiplexing	N/A

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.11 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in

Note 4:	uplink subframe SF#2 and #7. The respective received power spectral density of each interfering
	cell relative to N_{oc} ' is defined by its associated DIP value as
	specified in clause B.5.1.
Note 5:	Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.
Note 6:	Both cells are time-synchronous.
Note 7:	Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.
Note 8:	SINR corresponds to \widehat{E}_s/N_{oc} of Cell 1 as defined in clause
	8.1.1.
Note 9:	RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.
Note 10:	N/A.
Note 11:	· · · · · · · · · · · · · · · · · · ·
Note 12:	If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later
	than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 9.3.5.2.2-2 Minimum requirement (TDD)

γ	1.8
UE Category	≥2

9.3.6 Minimum requirement (With multiple CSI processes)

The purpose of the test is to verify the reporting accuracy of the CQI and the UE processing capability for multiple CSI processes. Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.3.6-1. For UE supports one CSI process, CSI process 2 is configured and the corresponding requirements shall be fulfilled. For UE supports three CSI processes, CSI processes 0, 1 and 2 are configured and the corresponding requirements shall be fulfilled. For UE supports four CSI processes, CSI processes 0, 1, 2 and 3 are configured and the corresponding requirements shall be fulfilled.

Table 9.3.6-1: Configuration of CSI processes

	CSI process 0	CSI process 1	CSI process 2	CSI process 3
CSI-RS resource	CSI-RS signal 0	CSI-RS signal 1	CSI-RS signal 0	CSI-RS signal 1
CSI-IM resource	CSI-IM resource 0	CSI-IM resource 0	CSI-IM resource 1	CSI-IM resource 2

9.3.6.1 FDD

For the parameters specified in Table 9.3.6.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band for CSI process 1, 2, or 3;
- b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least δ % of the time for CSI process 0;
- c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.1-3;

- d) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;
- e) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.6.1-1: Fading test for FDD

Parameter		Unit Test 1				st 1		Test 2			
			TP		TP2		TP1 TP2		P2		
Bandwidth Transmission mode		MHz			MHz		10 MHz				
Transmiss			10		1	0	10 10		0		
	$ ho_{\scriptscriptstyle A}$	dB		()						
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		()			(0		
allocation	P_c	dB	-3	3	()	-	3	()	
	σ	dB		-	3			_	3		
SNR (Note 7)	dB	10	11	7	8	14	15	9	10	
\hat{I}_{c}	(j) or	dB[mW/15kHz]	-88	-87	-91	-90	-84	-85	-89	-88	
N	(j) oc	dB[mW/15kHz]		-6	98			-(98		
Propagatio	on channel		EPA 5	Low	Clause wi $ au_d = 0$ a = $f_D = 0$	th $.45 \mu$ s,	EPA	5 Low	$\tau_d = 0$ $a = 0$	B.2.4.1 ith 0.45 μs, = 1, = 5 Hz	
Antenna co	onfiguration		4x	2	2)	(2	4	x2	2:	x2	
Beamform	ning Model		As spe		Section	B.4.3	As sp		Section	B.4.3	
	between TPs	us)				0		
Frequency offs Cell-specific re		Hz	ļ ,) norto 0.1				0 0 1		
CSI-RS	Ŭ		Antenna 15,	a ports	ports 0,1 N	/A	Antenr	na ports ,18	ports 0,1	/A	
	and subframe offset / $\Delta_{\text{CSI-RS}}$		5/1		N,	/A		/1	N	/A	
CSI-RS 0 c			0		N/A		0		N	/A	
CSI-RS	J		N/A		Antenna ports 15,16		Ν	/A		na ports ,16	
T _{CSI-RS}	and subframe offset $/$ $\Delta_{\text{CSI-RS}}$		N/A		5/1		N/A		5	/1	
CSI-RS 1 c	onfiguration		N/A		5		N	/A		5	
Zero-power CSI-F Icsi-Rs / ZeroPow	RS 0 configuration erCSI-RS bitmap		N/A		0000			/A	111000	/ 000000 00	
	RS 1 configuration erCSI-RS bitmap		1 / 00100110000 00000		00100110000 N/A		00100	/ 110000 000	N	/A	
	and subframe offset ∕ ∆csi-RS		5/	1	5/1		5	/1	5	/1	
CSI-IM 0 co	onfiguration		2		2	2		2	2	2	
	and subframe offset $/$ $\Delta_{\text{CSI-RS}}$		5/	1	N,	/A	5	/1	N	/A	
CSI-IM 1 co			6		N,	/A	-	6	N	/A	
T _{CSI-RS}	and subframe offset ∕ ∆csi-Rs		N/	A	5,	/1	N	/A	5.	/1	
CSI-IM 2 co	onfiguration		N/		1		N	/A		1	
	CSI-RS				RS 0				RS 0		
	CSI-IM Reporting mode			PUCC	·IM 0				-IM 0 CH 1-1		
	CodeBookSubsetR estriction bitmap		0x0		0 0000 0	001	0x0		0 0000 0	001	
	Reporting periodicity	ms		N pd	= 5				od = 5		
CSI process 0 Periodicity CQI delay		ms		1	1			1	1		
	Physical channel for CQI/ PMI reporting				(Note 6)				(Note 6)		
	PUCCH Report Type for CQI/PMI			2	2			:	2		
	PUCCH channel		F	PUCCH	Format 2			PUCCH	Format 2)	

	for RI reporting					
	PUCCH report		,	2	,)
	type for RI		,	3	3)
	cqi-pmi-			4	4	1
	ConfigurationIndex			-		
	ri-ConfigIndex			2	2	
	CSI-RS		CSI-		CSI-	
	CSI-IM			·IM 0	CSI-	
	Reporting mode		PUSC	CH 3-1	PUSC	H 3-1
	CodeBookSubsetR		000	001	000	001
CSI process 1	estriction bitmap		333			
	Reporting interval (Note 10)	ms		5	5	
	CQI delay	ms		1	1	
	Sub-band size	RB	6 (full		6 (full	
	CSI-RS			RS 0	CSI-	
	CSI-IM		CSI-		CSI-	
	Reporting mode		PUSC	CH 3-1	PUSC	:H 3-1
CSI process 2	CodeBookSubsetR	0x0000 0000 0001 0x0000 0		0x0000 0000 0000 0001		0 0000 0001
(For UE configured	estriction bitmap		G. 1000 0000 0000 000 1		0,0000 0000 0000	
single process)	Reporting interval	ms	!	5	5	
	(Note 8)					
	CQI delay	ms	8		8 6 (full size) (Note 9)	
	Sub-band size	RB	6 (full size			
	CSI-RS		CSI-		CSI-RS 1	
	CSI-IM			IM 2	CSI-IM 2	
	Reporting mode		PUSC	CH 3-1	PUSC	SH 3-1
001	CodeBookSubsetR		000	001	000	001
CSI process 3	estriction bitmap					
	Reporting interval (Note 10)	ms		5	Ę	
	CQI delay	ms	•	1	1	
	Sub-band size	RB	6 (full		6 (full	
CSI process for P				ocess 2	CSI pro	cess 2
Cel			0	6	0	6
Quasi-co-loc	ated CSI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
Quasi-co-located CRS			Same Cell ID	Same Cell ID	Same Cell ID	Same Cell ID
3,000,0010			as Cell 1	as Cell 2	as Cell 1	as Cell 2
PMI for subframe 2, 3, 4, 7, 8 and 9			0x0000 0000 0000 0001	100000	0x0000 0000 0000 0001	100000
PMI for subfr	ame 1 and 6		0x0000 0000 0001 0000	100000	0x0000 0000 0001 0000	100000
Max number of HA	RQ transmissions		1	N/A	1	N/A

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: 3 symbols allocated to PDCCH
- Note 3: Reference measurement channel RC.12 FDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 2, 3, 4, 7, 8 and 9 from TP1.
- Note 4: TM10 OCNG OP.8 FDD as specified in A.5.1.8 is transmitted on subframe 1 and 6 from TP1.
- Note 5: TM10 OCNG OP.8 FDD as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2
- Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#2 and #7.
- Note 7: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.
- Note 9: For these sub-bands which are not selected for PDSCH transmission, TM10 OCNG should be transmitted.
- Note 10: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#2 and #7 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#1 and #6.

Table 9.3.6.1-2: Minimum requirement (FDD)

	CSI process 0	CSI process 1	CSI process 2	CSI process 3			
α[%]	N/A	2	2	2			
β[%]	N/A	40	40	40			
δ [%]	10	N/A	N/A	N/A			
γ	N/A	N/A	1.02	N/A			
UE Category	≥1						

Table 9.3.6.1-3: Minimum median CQI difference between configured CSI processes (FDD)

	CSI process 1	CSI process 2	CSI process 3
CSI process 0	N/A	1	3
UE Category		≥1	

9.3.6.2 TDD

For the parameters specified in Table 9.3.6.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.6.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band for CSI process 1, 2, or 3;
- b) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least δ % of the time for CSI process 0;
- c) the difference of the median CQIs of the reported wideband CQI for configurated CSI processes shall be greater or equal to the values as in Table 9.3.6.2-3;
- d) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be $\geq \gamma$;
- e) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD, each available downlink transmission instance for TDD. Sub-bands of a size smaller than full size are excluded from the test.

Table 9.3.6.2-1: Fading test for TDD

Parameter		11-24	Test 1				Test 2			
		Unit	TF		TP2		TP1 TP2			
Bandwidth		MHz			MHz		10 MHz			
Transmission mode			_	0	10		10		10	
Uplink downlink cor			2			2	2		2	
Special subframe co			4	1		4	4	4) '	4
	$ ho_{\scriptscriptstyle A}$	dB			0					
Downlink power allocation	$\rho_{\scriptscriptstyle B}$	dB			0)	
allocation	P_c	dB	-;	3)	-	3		0
SNR (Note 7)	σ	dB dB	10	11	3	8	14	15	3 9	10
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-87	-91	-90	-84	-85	-89	-88
$N_{oc}^{(j)}$		dB[mW/15kHz]		_9	<u> </u>				<u> </u> 98	
1 voc		ab[iiiw/ fokt i2]	1			iuse				ause
Propagation channe	el		EPA !	5 Low	$B.2.4.$ $\tau_d = 0$ $a = 0$	1 with 0.45 μs, = 1, = 5 Hz	EPA	5 Low	$B.2.4.$ $\tau_d = 0$ $a = 0$	1 with 0.45 μs, = 1, = 5 Hz
Antenna configurati			4)			x2		x2		x2
Beamforming Mode			As sp		Section	B.4.3	As sp	ecified in		B.4.3
Timing offset betwe		US	1		0 0				<u>) </u>	
Frequency offset be Cell-specific referen		Hz	1		ports 0,1			Antenna		
CSI-RS signal 0	ice digitals		Antenna ports 15,, 18			/A	Antenr	na ports		/A
CSI-RS 0 periodicity T _{CSI-RS} / Δ _{CSI-RS}	y and subframe offset		5/3		N/A		15,, 18 5/3		N	/A
CSI-RS 0 configura	tion		0		N	N/A 0		0	N	/A
CSI-RS signal 1			N/A		Antenna ports 15, 16		/A		na ports , 16	
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	y and subframe offset		N/A		5/3 N/A				/3	
CSI-RS 1 configura	tion		N,			5		/A		5
Zero-power CSI-RS Icsi-RS / ZeroPower(N/A		3 / 11100000000 00000			/A	11100	3 / 000000 000
Zero-power CSI-RS I _{CSI-RS} / ZeroPower(3 / 00100110000 00000		N/A		00100	3 / 110000 000	N	/A
CSI-IM 0 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5,	/3	5	/3	5	/3	5	/3
CSI-IM 0 configurat			2	2	:	2	:	2	:	2
CSI-IM 1 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/	/3	N	/A	5	/3	N	/A
CSI-IM 1 configurat			(3	N	/A	(6	N	/A
CSI-IM 2 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		N.	/A	5	/3	N	/A	5	/3
CSI-IM 2 configurat	ion		N.	/A		1	N	/A		1
J	CSI-RS			CSI-	RS 0			CSI-	RS 0	
	CSI-IM				-IM 0				·IM 0	
	Reporting mode			PUCC	CH 1-1			PUCC	CH 1-1	
	CodeBookSubsetR estriction bitmap		0x0	000 000	0 0000 0	001	0x0	000 000	0 0000 0	001
CSI process 0	Reporting periodicity	ms			= 5				= 5	
	CQI delay	ms		1	2			1	2	
	Physical channel for CQI/ PMI reporting			PUSCH	(Note 6)			PUSCH	(Note 6)	
	PUCCH Report			-	2		2			

	Type for CQI/PMI					
	PUCCH channel for RI reporting		PUCCH	Format 2	PUCCH	Format 2
	PUCCH report type for RI		;	3	3	3
	cqi-pmi- ConfigurationIndex		;	3	3	3
	ri-ConfigIndex		805 (N	ote 10)	805 (N	ote 10)
	CSI-RS		CSI-	RS 1	CSI-	RS 1
	CSI-IM		CSI-	-IM 0	CSI-	IM 0
	Reporting mode		PUSC	CH 3-1	PUSC	CH 3-1
CSI process 1	CodeBookSubsetR estriction bitmap		000	001	000	001
•	Reporting interval (Note 9)	ms		5	ţ	5
	CQI delay	ms	1	2	1	2
	Sub-band size	RB	6 (ful	l size)	6 (full	size)
	CSI-RS			RS 0	CSI-	
	CSI-IM			-IM 1	CSI-	
	Reporting mode		PUSC	PUSCH 3-1		CH 3-1
CSI process 2	CodeBookSubsetR					
	estriction bitmap		000000000	0 0000 0001	0x0000 0000	0 0000 0001
·	Reporting interval (Note 9)	ms		5		5
	CQI delay	ms	1	12		2
	Sub-band size	RB	6 (full size	e) (Note 8)	6 (full size) (Note 8)	
	CSI-RS			RS 1	CSI-RS 1	
	CSI-IM		CSI-	·IM 2	CSI-IM 2	
	Reporting mode		PUSC	CH 3-1	PUSCH 3-1	
CSI process 3	CodeBookSubsetR estriction bitmap		000	0001	000001	
·	Reporting interval (Note 9)	ms		5	ţ	5
	CQI delay	ms	1	2	1	2
	Sub-band size	RB	6 (ful	l size)	6 (full	size)
CSI process for PI	DSCH scheduling		CSI pro	ocess 2	CSI pro	ocess 2
Cell ID			0	6	0	6
Quasi-co-located (CSI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
Quasi-co-located	CRS		Same Cell ID as Cell 1	Same Cell ID as Cell 2	Same Cell ID as Cell 1	Same Cell ID as Cell 2
PMI for subframe	4 and 9		0x0000 0000 0000 0001	100000	0x0000 0000 0000 0001	100000
PMI for subframe	3 and 8		0x0000 0000 0001 0000	100000	0x0000 0000 0001 0000	100000
Max number of HA	ARQ transmissions		1	N/A	1	N/A
ACK/NACK feedba	ack mode		Multiplexing	N/A	Multiplexing	N/A
Note to the state of the state)		decombinate OF most

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: 3 symbols allocated to PDCCH
- Note 3: Reference measurement channel RC.12 TDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 4 and 9 from TP1.
- Note 4: TM10 OCNG OP.8 TDD is transmitted as specified in A.5.2.8 on subframe 3 and 8 from TP1.
- Note 5: TM10 OCNG OP.8 TDD is transmitted as specified in A.5.2.8 on subframe 3, 4, 8 and 9 from TP2
- Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 7: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3 and #8 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#7 and #2.
- Note 9: For these sub-bands which are not selected for PDSCH transmission, TM10 OCNG should be transmitted.
- Note 10: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.

Table 9.3.6.2-2: Minimum requirement (TDD)

	CSI process 0	CSI process 1	CSI process 2	CSI process 3		
<i>α</i> [%]	N/A	2	2	2		
β[%]	N/A	40	40	40		
δ[%]	10	N/A	N/A	N/A		
γ	N/A	N/A	1.02	N/A		
UE Category	≥1					

Table 9.3.6.2-3: Minimum median CQI difference between configured CSI processes (TDD)

	CSI process 1	CSI process 2	CSI process 3
CSI process 0	N/A	1	3
UE Category		≥1	

9.3.7 Minimum requirement PUSCH 3-2

9.3.7.1 FDD

For the parameters specified in Table 9.3.7.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.7.1-2 and by the following.

- a) the ratio of the throughput obtained when transmitting based on UE PUSCH 3-2 reported wideband CQI and subband PMI and that obtained when transmitting based on PUSCH 3-1 reported wideband CQI and wideband PMI shall be $\geq \alpha$;
- b) The ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS based on UE PUSCH3-2 reported subband CQI and subband PMI and that obtained when transmitting on a randomly selected sub-band in set S based on PUSCH 1-2 reported wideband CQI and subband PMI shall be $\geq \beta$;

The transport block sizes TBS for wideband CQI and subband CQI are selected according to RC.17 FDD for test 1 and according to RC.18 FDD for test 2.

Table 9.3.7.1-1 Sub-band test for FDD

Parameter		Unit	Test 1		Test 2		
Bandwidth		MHz		101	ИНz		
PDSCH resource allocation		RB	50PRB		a subbai	nd, 6PRB	
Transmiss	ion mode		T	M6	TI	M9	
	$ ho_{_{A}}$	dB		-6		0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		-6		0	
allocation	P_c	dB		-	-	3	
	σ	dB		3	-	3	
SNR (N	lote 3)	dB	0	1	5	6	
$\hat{I}_{oi}^{()}$	j) -	dB[mW/15kHz]	-98	-97	-93	-92	
$N_o^{()}$	(j) c	dB[mW/15kHz]	-98 -98		-98	-98	
Propagatio	Propagation channel		EVA5		EVA5		
Antenna co	nfiguration		4x2 ULA low		4x2 XP high (Note 4)		
Beamformi				-	B.4.3		
CRS referer			Antenna po	orts 0, 1, 2, 3	Antenna ports 0, 1		
Time offset between 5)	TX antenna (Note	ns	65		-		
CSI referen	ce signals				Antenna ports 15, 16, 17, 18		
CSI-RS periodicity a				-	5/ 1		
CSI-RS reference s	ignal configuration			-		4	
alternativeCodeboo			1	No	Y	es	
CodeBookSubsetF	Restriction bitmap		0x0000 000	00 0000 FFFF		0 0000 FFFF FFFF	
Reporting inte	rval (Note 6)	ms		5		5	
CQI d		ms		8		8	
Reporting	g mode		PUSCH 3-2	2, PUSCH 3-1	PUSCH 3-2	, PUSCH 1-2	
Sub-bar	nd size	RB	6 (fu	ll size)	6 (full size)		
Max number of HA				1		1	

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.17 FDD / RC.18 FDD for Test 1 / 2 according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4.
- Note 5: The values of time offset are [0ns 65ns 0ns 65ns] for antenna port [0, 1, 2, 3] respectively.
- Note 6: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.

Table 9.3.7.1-2 Minimum requirement (FDD)

	Test 1	Test 2
α	1.05	-
β	-	1.15
UE Category	≥2	≥2

9.3.7.2 TDD

For the parameters specified in Table 9.3.7.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.3.7.2-2 and by the following.

a) the ratio of the throughput obtained when transmitting based on UE PUSCH 3-2 reported wideband CQI and subband PMI and that obtained when transmitting based on PUSCH 3-1 reported wideband CQI and wideband PMI shall be >\alpha:

b) The ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS based on UE PUSCH3-2 reported subband CQI and subband PMI and that obtained when transmitting on a randomly selected sub-band in set S based on PUSCH 1-2 reported wideband CQI and subband PMI shall be ≥β;

The transport block sizes TBS for wideband CQI and subband CQI are selected according to RC.17 TDD for test 1 and RC.18 TDD for test 2.

Table 9.3.7.2-1 Sub-band test for TDD

Parameter		Unit	Test 1		Test 2	
Bandwidth		MHz			MHz	
PDSCH resou	rce allocation	RB	50	PRB	a subbar	nd, 6PRB
Transmiss	ion mode		TM6		TM9	
Uplink downlink	configuration			1		1
Special subfram	e configuration			4	4	4
	$ ho_{\scriptscriptstyle A}$	dB		-6		0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		-6		0
allocation	P_c	dB		-	-	3
	σ	dB		3	-	3
SNR (N	lote 3)	dB	0	1	5	6
$\hat{I}_{o}^{(}$	j) r	dB[mW/15kHz]	-98	-97	-93	-92
N_c	(j) oc	dB[mW/15kHz]	-98	-98	-98	-98
Propagation channel			E/	/A5	EVA5	
Antenna co	nfiguration		4x2 U	ILA low	4x2 XP hig	gh (Note 4)
Beamform				-		4.3
CRS referei	Ü		Antenna po	orts 0, 1, 2, 3	Antenna	ports 0, 1
Time offset between TX antenna (Note 5)		ns	65			-
CSI reference signals					Antenna ports	15, 16, 17, 18
CSI-RS periodicity a				-	5/	⁷ 4
CSI-RS reference signal configuration			-		4	
alternativeCodebookEnabledFor4TX			No		Yes	
CodeBookSubsetF	Restriction bitmap		0x0000 000	0 0000 FFFF		0 0000 FFFF FFFF
Reporting inte		ms	5			5
CQI o		ms		8		8
Reportin			PUSCH 3-2	, PUSCH 3-1	PUSCH 3-2,	, PUSCH 1-2
Sub-bai		RB	6 (fu	ll size)	6 (ful	l size)
Max number of HA	RQ transmissions			1	,	1

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.17 TDD / RC.18 TDD for Test 1 / 2 according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4.
- Note 5: The values of time offset are [0ns 65ns 0ns 65ns] for antenna port [0, 1, 2, 3] respectively.
- Note 6: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#3 and #8.

Table 9.3.7.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α	1.05	-
β	-	1.15
UE Category	≥2	≥2

9.3.8 Additional requirements for enhanced receiver Type B

The purpose of the test is to verify that the reporting of the channel quality based on the receiver of the enhanced Type B meets a minimum performance. Performance requirements are specified in terms of the relative throughput obtained when the transport format is that indicated by the reported CQI with NeighCellsInfo-r12 configured compared to the case without NeighCellsInfo-r12 configured. Cell 1 is the serving cell, and Cell 2 and Cell 3 are the interference cells.

9.3.8.1 Minimum requirement PUCCH 1-1 (Cell-Specific Reference Symbols)

9.3.8.1.1 FDD

For the parameters specified in Table 9.3.8.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.1.1-2 and by the following

Table 9.3.8.1.1-1 Fading test for FDD

Parameter		Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz	10		
Transmission mode			4		
	$ ho_{\scriptscriptstyle A}$	dB	-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-3	
	σ	dB		0	
Cyclic Prefix			Normal	Normal	Normal
Cell ID			0	1	6
SNR		dB	8.34	N/A	N/A
\hat{E}_s/N_{oc}			N/A	3.28	0.74
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26
N_{oc}		dB [mW/15kHz]		-98	
Propagation channel			EPA5	EPA5	EPA5
Correlation and antenna configuration			Low 2 x 2	Low 2 x 2	Low 2 x 2
Cell-specific refere	ence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
Interference model			N/A	As specified in clause B.6.3	As specified in clause B.6.3
Reporting periodicity		ms	$N_{pd} = 5$	N/A	N/A
Physical channel	Physical channel for CQI/PMI reporting		PUCCH Format 2	N/A	N/A
PUCCH Report Ty	pe for CQI/PMI		2	N/A	N/A
PUCCH Report Ty	/pe for RI		3	N/A	N/A
cgi-pmi-ConfigurationIndex			6	N/A	N/A
ri-ConfigurationIndex CodeBookSubsetRestriction bitmap			1	N/A	N/A
			000001	N/A	N/A
Max number of H	ARQ transmissions		1	N/A	N/A
NeighCellsInfo-	p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
r12 (Note 4)	transmissionModeList -r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}
N. 4 1641 1.1		1. 1		05"	001

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 3: All cells are time-synchronous.

Note 4: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.1.1-2 Minimum requirement (FDD)

	Test 1
γ	0.925
UE Category	≥2

9.3.8.1.2 TDD

For the parameters specified in Table 9.3.8.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.8.1.2-2 and by the following

Table 9.3.8.1.2-1 Fading test for TDD

Pa	rameter	Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz		10	
Transmission mode			4		
Uplink downlink co			2		
Special subframe	configuration			4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		-3	
allocation	$ ho_{\scriptscriptstyle B}$	dB			
	σ	dB		0	
Cyclic Prefix			Normal	Normal	Normal
Cell ID			0	1	6
SNR		dB	8.34	N/A	N/A
\hat{E}_s/N_{oc}			N/A	3.28	0.74
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26
N_{oc}		dB [mW/15kHz]	-98		
Propagation channel			EPA5	EPA5	EPA5
Correlation and ar	ntenna configuration		Low 2 x 2	Low 2 x 2	Low 2 x 2
Cell-specific refere	ence signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
Interference model			N/A	As specified in clause B.6.3	As specified in clause B.6.3
Reporting periodicity		ms	$N_{pd} = 5$	N/A	N/A
Physical channel f	for CQI/PMI reporting		PUSCH (Note 3)	N/A	N/A
PUCCH Report Ty	/pe		2	N/A	N/A
cqi-pmi-Configura	cqi-pmi-ConfigurationIndex		3	N/A	N/A
ri-ConfigIndex			805 (Note 5)	N/A	N/A
CodeBookSubsetRestriction bitmap		·	000001	N/A	N/A
Max number of HARQ transmissions			1	N/A	N/A
ACK/NACK feedb	ack mode		Multiplexing	N/A	N/A
NeighCellsInfo-	p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
r12 (Note 6)	transmissionModeList -r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: All cells are time-synchronous.
- Note 5: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.
- Note 6: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.1.2-2 Minimum requirement (TDD)

	Test 1
γ	0.925
UE Category	≥2

9.3.8.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbols)

9.3.8.2.1 FDD

For the parameters specified in Table 9.3.8.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.2.1-2 and by the following

Table 9.3.8.2.1-1 Fading test for FDD

Parameter		Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz	10		
Transmission	mode		9		
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0	
allocation	Pc	dB		0	
	σ	dB		0	
Cyclic Prefix			Normal	Normal	Normal
Cell ID			0	1	6
SNR		dB	8.34	N/A	N/A
\widehat{E}_s/N_{oc}			N/A	3.28	0.74
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26
N_{oc}		dB [mW/15kHz]		-98	
Propagation (_	EPA5	EPA5	EPA5
Correlation a configuration			Low 2 x 2	Low 2 x 2	Low 2 x 2
	reference signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1
Beamforming	Model			specified in Section B	.4.3
CSI reference	e signals		Antenna ports 15,16	N/A	N/A
CSI-RS perior subframe offs			5/1	N/A	N/A
CSI-RS refer configuration			2	N/A	N/A
Zero-power C configuration I _{CSI-RS} / ZeroF bitmap		Subframes / bitmap	N/A	1 / 00010000000000 00	1 / 00010000000000 00
CodeBookSu bitmap	bsetRestriction		000001	N/A	N/A
Interference	model		N/A	As specified in clause B.6.4	As specified in clause B.6.4
Reporting pe	riodicity	ms	$N_{pd} = 5$	N/A	N/A
Physical cha reporting	nnel for CQI/PMI		PUSCH (Note 3)	N/A	N/A
PUCCH Repo	ort Type for		2	N/A	N/A
PUCCH char reporting	nnel for RI		PUCCH Format 2	N/A	N/A
	ort Type for RI		3	N/A	N/A
	igurationIndex		2	N/A	N/A
ri-ConfigInde			1	N/A	N/A
Max number					
transmissions			1	N/A	N/A
NeighCellsInf	p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
-r12 (Note 5)			N/A	{2,3,4,8,9}	{2,3,4,8,9}

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5
- Note 4: All cells are time-synchronous.
- Note 5: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.2.1-2 Minimum requirement (FDD)

	Test 1
γ	0.925
UE Category	≥2

9.3.8.2.2 TDD

For the parameters specified in Table 9.3.8.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.3.8.2.2-2 and by the following

Table 9.3.8.2.2-1 Fading test for TDD

Par	ameter	Unit	Cell 1	Cell 2	Cell 3		
Bandwidth		MHz		10			
Transmission	mode		9				
$ ho_{\scriptscriptstyle A}$		dB		0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0			
allocation	Pc	dB	0				
	σ	dB	0				
Uplink downlin	nk configuration			2			
Special subfra	ame configuration		4				
Cyclic Prefix			Normal	Normal	Normal		
Cell ID			0	1	6		
SNR		dB	8.34	N/A	N/A		
\widehat{E}_s/N_{oc}			N/A	3.28	0.74		
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26		
N_{oc}		dB [mW/15kHz]		-98			
Propagation of			EPA5	EPA5	EPA5		
Correlation ar configuration			Low 2 x 2	Low 2 x 2	Low 2 x 2		
Cell-specific r	eference signals		Antenna ports 0,1	Antenna ports 0,1	Antenna ports 0,1		
Beamforming Model			As spe	ecified in Section B.4			
CSI reference signals			Antenna ports 15,16	N/A	N/A		
CSI-RS period subframe offs			5/3	N/A	N/A		
CSI-RS reference			2	N/A	N/A		
Zero-power C configuration $I_{\text{CSI-RS}} / Z\epsilon$ bitmap	eroPowerCSI-RS	Subframes / bitmap	N/A	3 / 0001000000000 000	3 / 0001000000000 000		
CodeBookSul bitmap	osetRestriction		000001	N/A	N/A		
Interference n	nodel		N/A	As specified in clause B.6.4	As specified in clause B.6.4		
Reporting per		ms	$N_{\rm pd} = 5$	N/A	N/A		
reporting	nnel for CQI/PMI		PUSCH (Note 3)	N/A	N/A		
PUCCH Repo	ort Type for		2	N/A	N/A		
Physical chan reporting	nel for RI		PUCCH Format 2	N/A	N/A		
PUCCH Report Type for RI			3	N/A	N/A		
cqi-pmi-ConfigurationIndex			3	N/A	N/A		
ri-ConfigIndex			805 (Note 5)	N/A	N/A		
Max number of transmissions			1	N/A	N/A		
ACK/NACK fe	edback mode		Multiplexing	N/A	N/A		
NeighCellsInfo	n al ict r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}		
-r12 (Note 6)	transmission ModeList-r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}		
Note 1. If the		and the later of the later	reporting instance at su	L. f O E #	001		

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.11 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7.
- Note 4: All cells are time-synchronous.

Note 5:	RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between
	RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that
	CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report
	collection shall be skipped every 160ms during performance verification and the reported CQI in
	subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after
	CQI/PMI dropping) is available.
	11 0/

Note 6: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7]

Table 9.3.8.2.2-2 Minimum requirement (TDD)

	Test 1
γ	0.925
UE Category	≥2

9.3.8.3 Minimum requirement with CSI process

9.3.8.3.1 FDD

For the parameters specified in Table 9.3.8.3.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.3.1-2 and by the following

a) the ratio of the throughput obtained for the Type B receiver with NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with specified \hat{E}_s/N_{oc} and that obtained for the Type B receiver without NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with the same specified \hat{E}_s/N_{oc} shall be $\geq \gamma$;

Table 9.3.8.3.1-1 Fading test for single antenna (FDD)

	Parameter		Cell 1	Cell 2	Cell 3
Bandwidth		MHz		10	
Transmission mode			10	9	9
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0	
allocation	Pc	dB		0	
ļ	σ	dB		0	
Cyclic Prefix	-		Normal	Normal	Normal
Cell ID			0	1	6
SNR		dB	8.34	N/A	N/A
\hat{E}_s/N_{oc}		dB	N/A	3.28	0.74
$\hat{I}_{or}^{(j)}$		dB [mW/15kHz]	-89.66	-94.72	-97.26
N_{oc}		dB[mW/15kHz]		-98	
Propagation channe	el		EPA5	EPA5	EPA5
Correlation and ante	enna configuration		Low 2 x 2	Low 2 x 2	Low 2 x 2
Cell-specific referen	•		Antenna ports 0,1	Antenna port 0, 1	Antenna port 0, 1
Beamforming Mode				ecified in Section I	B.4.3
CSI reference signa			Antenna ports 15,16	N/A	N/A
CSI-RS periodicity a			5/1	N/A	N/A
CSI-RS reference si	ignal configuration		2	N/A	N/A
Zero-power CSI-RS configuration l _{CSI-RS} / ZeroPowerCSI-RS bitmap		Subframes / bitmap	N/A	1 / 000100000000 0000	1 / 00010000000 00000
Interference model			N/A	As specified in clause B.6.4	As specified in clause B.6.4
	CSI-RS		CSI-RS	N/A	N/A
_	CSI-IM		CSI-IM	N/A	N/A
	Reporting mode		PUCCH 1-1	N/A	N/A
	CodeBookSubsetRe striction bitmap		000001	N/A	N/A
	Reporting periodicity	ms	$N_{\rm pd} = 5$	N/A	N/A
}	CQI delay Physical channel for	ms	8 PUSCH	N/A	N/A
CCI =======	CQI/ PMI reporting		(Note 3)	N/A	N/A
CSI process	PUCCH Report Type for CQI/PMI		2	N/A	N/A
	PUCCH channel for RI reporting		PUCCH Format 2	N/A	N/A
	PUCCH report type for RI		3	N/A	N/A
	cqi-pmi- ConfigurationIndex		2	N/A	N/A
ri-ConfigIndex			1	N/A	N/A
CSI-IM periodicity a $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	nd subframe offset		5/1	N/A	N/A
CSI-IM configuration			6	N/A	N/A
CSI process for PDSCH scheduling			CSI process	N/A	N/A
Quasi-co-located CSI-RS			CSI-RS	N/A	N/A
Quasi-co-located CRS			Same Cell ID as Cell 1	N/A	N/A
Reference measurement channel			Note 2	N/A	N/A
Max number of HAR	RQ transmissions		1	N/A	N/A
NeighCellsInfo-	p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
r12 (Note 5)	transmissionModeLis t-r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG

	Pattern OP.1 FDD as described in Annex A.5.1.1.
Note 3:	To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH
	instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic
	COL/ PMI to multipley with the HARO-ACK on PUSCH in unlink subframe SF#0 and #5

Note 4: All cells are time-synchronous.

Note 5: NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.3.1-2 Minimum requirement (FDD)

	Test 1
γ	0.925
UE Category	≥2

9.3.8.3.2 TDD

For the parameters specified in Table 9.3.8.3.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.3.8.3.2-2 and by the following

a) the ratio of the throughput obtained obtained for the Type B receiver with NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with specified \hat{E}_s/N_{oc} and that obtained for the Type B receiver without NAICS assistance information when transmitting the transport format indicated by each reported wideband CQI index subject to interference sources with the same specified \hat{E}_s/N_{oc} shall be $\geq \gamma$;

Table 9.3.8.3.2-1 Fading test for single antenna (TDD)

	Parameter	Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz		10	
Transmission mode			10	9	9
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0	
allocation	Pc	dB		0	
	σ	dB		0	
Uplink downlink co	_	UD.		2	
Special subframe				4	
Cyclic Prefix	501111garation		Normal	Normal	Normal
Cell ID			0	1	6
SNR		dB	8.34	N/A	N/A
\hat{E}_s/N_{oc}		dB	N/A	3.28	0.74
		dB	14/74	0.20	0.7 1
$\hat{I}_{or}^{(j)}$		[mW/15kHz]	-89.66	-94.72	-97.26
		dB[mW/15k			
N_{oc}		Hz]		-98	
Propagation chann	nel	•	EPA5	EPA5	EPA5
	tenna configuration		Low 2 x 2	Low 2 x 2	Low 2 x 2
Cell-specific refere			Antenna ports	Antenna port	Antenna port
•	· ·		0,1	0,1	0,1
Beamforming Mod	el			ecified in Section	B.4.3
CSI reference sign	als		Antenna ports	N/A	N/A
			15,16		
	and subframe offset		5/3	N/A	N/A
CSI-RS reference	signal configuration		2	N/A	N/A
Zero-power CSI-R	S configuration	Subframes /		3/	3/
	werCSI-RS bitmap	bitmap	N/A	000100000000	00010000000 00000
		·		As specified in	As specified in
Interference model			N/A	clause B.6.4	clause B.6.4
	CSI-RS		CSI-RS	N/A	N/A
	CSI-IM		CSI-IM	N/A	N/A
	Reporting mode		PUCCH 1-1	N/A	N/A
	CodeBookSubsetRestricti				
	on bitmap		000001	N/A	N/A
	Reporting periodicity	ms	$N_{pd} = 5$	N/A	N/A
	CQI delay	ms	8	N/A	N/A
	Physical channel for CQI/		PUSCH	N/A	N/A
CSI process	PMI reporting		(Note 3)	IN/A	IN/A
	PUCCH Report Type for		2	N/A	N/A
	CQI/PMI				
	PUCCH channel for RI		PUCCH	N/A	N/A
	reporting PUCCH report type for RI		Format 2 3	N/A	N/A
	cqi-pmi-				
	ConfigurationIndex		3	N/A	N/A
ri-ConfigIndex			805 (Note 5)	N/A	N/A
CSI-IM periodicity and subframe offset T _{CSI-RS} /					
Δ csi-rs			5/1	N/A	N/A
CSI-IM configuration			6	N/A	N/A
CSI process for PE			CSI process	N/A	N/A
Quasi-co-located C	CSI-RS		CSI-RS	N/A	N/A
Quasi-co-located (CRS		Same Cell ID as Cell 1	N/A	N/A
Reference measurement channel			Note 2	N/A	N/A
Max number of HA			1	N/A	N/A
ACK/NACK feedba	ack mode		Multiplexing	N/A	N/A
NeighCellsInfo-	p-aList-r12		N/A	{dB-6, dB-3, dB0}	{dB-6, dB-3, dB0}
r12 (Note 6)	transmissionModeList-r12		N/A	{2,3,4,8,9}	{2,3,4,8,9}
Note 1: If the UE	reports in an available uplink	reporting instar			

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink

	before SF#(n+4)
Note 2:	Reference measurement channel RC.11 TDD according to Table A.4-1 with one sided dynamic OCNG
	Pattern OP.1 TDD as described in Annex A.5.2.1.
Note 3:	To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH
	instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic
	CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.
Note 4:	All cells are time-synchronous.
Note 5:	RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI,
	CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI
	reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall
	be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the
	previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.
Note 6:	NeighCellsInfo-r12 is described in subclause 6.3.2 of [7].

Table 9.3.8.3.2-2 Minimum requirement (TDD)

	Test 1
γ	0.925
UE Category	≥2

9.4 Reporting of Precoding Matrix Indicator (PMI)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 6, transmission mode 9 with 4 TX and transmission mode 9 with 8 TX *alternativeCodebookEnabledCLASSB_K1=TRUE* configured are specified in terms of the ratio

$$\gamma = \frac{t_{ue}}{t_{rnd}}.$$

In the definition of γ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements, t_{rnd} is 60% of the maximum throughput obtained at SNR_{rnd} using random precoding, and t_{ue} the throughput measured at SNR_{rnd} with precoders configured according to the UE reports;

For the PUCCH 2-1 single PMI requirement, t_{md} is 60% of the maximum throughput obtained at SNR_{md} using random precoding on a randomly selected full-size subband in set S subbands, and t_{ue} the throughput measured at SNR_{md} with both the precoder and the preferred full-size subband applied according to the UE reports;

For PUSCH 2-2 multiple PMI requirements, t_{rnd} is 60% of the maximum throughput obtained at SNR_{rnd} using random precoding on a randomly selected full-size subband in set S subbands, and t_{ue} the throughput measured at SNR_{rnd} with both the subband precoder and a randomly selected full-size subband (within the preferred subbands) applied according to the UE reports.

For PUCCH 1-1 single PMI requirement under transmission mode 9 with 4Tx and 8 TX when $alternativeCodebookEnabledCLASSB_K1=TRUE$ configured, t_{ue} is 70% of the maximum throughput obtained at SNR_{follow} using the precoders configured according to the UE reports, and t_{rnd} is the throughput measured at SNR_{follow} with random precoding.

The requirements for transmission mode 9 with 8 TX and transmission mode 9 with 4TX enhanced codebook are specified in terms of the ratio

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of γ , for PUSCH 3-1 single PMI, PUCCH 1-1 single PMI and PUSCH 1-2 multiple PMI requirements, $t_{follow1,follow2}$ is 70% of the maximum throughput obtained at $SNR_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t_{rnd1,rnd2}$ is the throughput measured at $SNR_{follow1,follow2}$ with random precoding.

The requirements for transmission mode 9 with 12 TX and 16 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue,follow1,1,follow1,2,follow2}}{t_{rnd1,1,rnd1,2,rnd2}}$$

In the definition of γ , for PUSCH 3-1 single PMI and PUSCH 1-2 multiple PMI requirements, $t_{ue, follow1,1, follow1,2, follow2}$ is 90% of the maximum throughput obtained at $SNR_{follow1,1, follow1,2, follow2}$ using the precoders configured according to the UE reports, and $t_{rnd1,1, rnd1,2, rnd2}$ is the throughput measured at $SNR_{follow1,1, follow1,2, follow2}$ with random precoding.

9.4.1 Single PMI

9.4.1.1 Minimum requirement PUSCH 3-1 (Cell-Specific Reference Symbols)

9.4.1.1.1 FDD

For the parameters specified in Table 9.4.1.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.1.1-2.

Table 9.4.1.1.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmiss	sion mode		6
Propagation	on channel		EVA5
Precoding	granularity	PRB	50
	tion and onfiguration		Low 2 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUSCH 3-1
Reporting	g interval	ms	1
PMI dela	y (Note 2)	ms	8
Measurement channel			R. 10 FDD
OCNG Pattern			OP.1 FDD
Max number of HARQ			4
transmissions			
	cy version equence		{0,1,2,3}

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 9.4.1.1.1-2 Minimum requirement (FDD)

Parameter	Test 1
γ	1.1
UE Category	≥1

9.4.1.1.2 TDD

For the parameters specified in Table 9.4.1.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.1.1.2-2.

Table 9.4.1.1.2-1: PMI test for single-layer (TDD)

Bandwidth MHz 10 Transmission mode 6 Uplink downlink configuration 1 Special subframe configuration 4 Propagation channel EVA5 Precoding granularity PRB 50 Correlation and antenna configuration Low 2 x 2 Downlink power allocation ρ _B dB -3 Downlink power allocation ρ _B dB -3 Downlink power allocation σ dB 0 N _{cc} dB 0 0 Reporting mode PUSCH 3-1 -98 Reporting interval ms 1 Reporting interval ms 1 PMI delay (Note 2) ms 10 or 11 Measurement channel R.10 TDD OCNG Pattern OP.1 TDD Max number of HARQ transmissions 4 Redundancy version coding sequence {0,1,2,3} ACK/NACK feedback mode Multiplexing Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at	Para	meter	Unit	Test 1
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Band	lwidth	MHz	10
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Transmis	sion mode		6
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Uplink o	downlink		1
configuration 4 Propagation channel EVA5 Precoding granularity PRB 50 Correlation and antenna configuration Low 2 x 2 Downlink power allocation Φ _A dB -3 Downlink power allocation Φ _B dB -3 MB 0 N _{oc} dB[mW/15kHz] -98 Reporting mode PUSCH 3-1 Reporting interval ms 1 PMI delay (Note 2) ms 10 or 11 Measurement channel R.10 TDD OCNG Pattern OP.1 TDD Max number of HARQ transmissions 4 Redundancy version coding sequence ACK/NACK feedback mode Multiplexing Note 1: For random precoder selection, the precoder shall be updated in each available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the				'
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				4
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			PRB	50
antenna configuration Downlink power allocation ρ_{B} dB -3 ρ_{B} dB -3 ρ_{B} dB 0 ρ_{B				Low 2 x 2
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	antenna co	onfiguration		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
Reporting mode PUSCH 3-1 Reporting interval ms 1 PMI delay (Note 2) ms 10 or 11 Measurement channel R.10 TDD OCNG Pattern OP.1 TDD Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the	power	$ ho_{\scriptscriptstyle B}$	dB	-3
Reporting mode PUSCH 3-1 Reporting interval ms 1 PMI delay (Note 2) ms 10 or 11 Measurement channel R.10 TDD OCNG Pattern OP.1 TDD Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the	allocation	σ	dB	0
Reporting interval ms 1 PMI delay (Note 2) ms 10 or 11 Measurement channel R.10 TDD OCNG Pattern OP.1 TDD Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the	$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
PMI delay (Note 2) ms 10 or 11 Measurement channel R.10 TDD OCNG Pattern OP.1 TDD Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the	Reporting mode			PUSCH 3-1
Measurement channel R.10 TDD OCNG Pattern OP.1 TDD Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the			ms	1
OCNG Pattern Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the	PMI dela	y (Note 2)	ms	10 or 11
Max number of HARQ transmissions Redundancy version coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the	Measurem	ent channel		R.10 TDD
transmissions Redundancy version coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n- 4), this reported PMI cannot be applied at the	OCNG	Pattern		OP.1 TDD
Redundancy version coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the	Max numb	er of HARQ		4
coding sequence ACK/NACK feedback mode Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the				-T
Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the				{0.1.2.3}
Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the				(0,1,2,0)
Note 1: For random precoder selection, the precoder shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the				Multiplexing
shall be updated in each available downlink transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the		mode		
transmission instance. Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the				
Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the				
instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the	_			
estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the		3		
4), this reported PMI cannot be applied at the				
LIND COMMINING DETOTE OF#(11+4).				

Table 9.4.1.1.2-2: Minimum requirement (TDD)

Parameter	Test 1
γ	1.1
UE Category	≥1

9.4.1.2 Minimum requirement PUCCH 2-1 (Cell-Specific Reference Symbols)

9.4.1.2.1 FDD

For the parameters specified in Table 9.4.1.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.1-2.

Table 9.4.1.2.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1		
Bandwidth		MHz	10		
Transmiss	sion mode		6		
	on channel		EVA5		
	tion and onfiguration		Low 4 x 2		
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6		
power	$ ho_{\scriptscriptstyle B}$	dB	-6		
allocation	σ	dB	3		
N	oc (j)	dB[mW/15kHz]	-98		
PMI	delay	ms	8 or 9		
Reportir	ng mode		PUCCH 2-1 (Note 6)		
	periodicity	ms	$N_{pd} = 2$		
	channel for porting		PUSCH (Note 3)		
PUCCH R for widebar	eport Type nd CQI/PMI		2		
	eport Type and CQI		1		
Measureme	ent channel		R.14-1 FDD		
OCNG	Pattern		OP.1/2 FDD		
Precoding	granularity	PRB	6 (full size)		
	bandwidth s (<i>J</i>)		3		
K			1		
cqi-pmi-ConfigIndex			1		
	er of HARQ		4		
transm	issions		4		
	cy version		{0,1,2,3}		
	equence				
	Note 1: For random precoder selection, the precoder shall be updated				
Note 2: I	every two TTI (2 ms granularity). Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).				
Note 3:	Note 3: To avoid collisions between HARQ-ACK and wideband CQI/PMI or subband CQI, it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.				
Note 4: F	te 4: Reports for the short subband (having 2RBs in the last bandwidth part) are to be disregarded and instead data is to be transmitted on the most recently used subband for bandwidth part with j=1.				
		nere wideband PMI n the most recently (is reported, data is to be used subband.		
Note 6: 1					

report on PUCCH.

Table 9.4.1.2.1-2: Minimum requirement (FDD)

	Test 1
γ	1.2
UE Category	≥1

9.4.1.2.2 TDD

For the parameters specified in Table 9.4.1.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.2.2-2.

Table 9.4.1.2.2-1: PMI test for single-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			6
Uplink downlink configuration			1
Special s	subframe uration		4
	on channel		EVA5
Correla			1 4 0
antenna co	nfiguration		Low 4 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6
power allocation	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
N_{i}		dB[mW/15kHz]	-98
	delay	ms	10
	ng mode		PUCCH 2-1 (Note 6)
	periodicity	ms	$N_{\rm P} = 5$
CQI re			PUSCH (Note 3)
PUCCH Refor widebar			2
PUCCH Refor subb	eport Type		1
	ent channel		R.14-1 TDD
OCNG			OP.1/2 TDD
	granularity	PRB	6 (full size)
Number of	bandwidth		3
part	_ ` ′		
K cai-pmi-ConfiaIndex			1 4
cqi-pmi-ConfigIndex Max number of HARQ			4
transm			4
	cy version		{0,1,2,3}
coding s	K fedback		
mo			Multiplexing
			ne precoder shall be updated in
		e downlink transmis	
			plink reporting instance at
			imation at a downlink SF not later
		i, this reported PMI (are SF#(n+4).	cannot be applied at the eNB
			Q-ACK and wideband CQI/PMI or
			port both on PUSCH instead of
F	PUCCH. PDC	CH DCI format 0 sh	nall be transmitted in downlink
			It o multiplex with the HARQ-ACK
		uplink subframe SF	
part) are to be disregarded and instead data is to be transmitted			stead data is to be transmitted on
the most recently used subband for bandwidth part with Note 5: In the case where wideband PMI is reported, data is to I			
		nere wideband Pivil In the most recently (
			in DCI format 1B shall be mapped
			indicate the codebook index used
			[4] according to the latest PMI
r	eport on PUC	JUH.	

Table 9.4.1.2.2-2: Minimum requirement (TDD)

	Test 1
γ	1.2
UE Category	≥1

9.4.1.3 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

9.4.1.3.1 FDD

For the parameters specified in Table 9.4.1.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.1-2.

Table 9.4.1.3.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmiss	sion mode		9
Propagation	on channel		EPA5
Precoding	granularity	PRB	50
Correlat	tion and		Low
antenna co			ULA 4 x 2
Cell-specific	c reference		Antenna ports
sigr	nals		0,1
CSI referer	nce signals		Antenna ports 15,,18
Beamform			Annex B.4.3
CSI-RS periodicity and subframe offset Tcsi-RS / Δcsi-Rs			5/ 1
CSI-RS r			6
signal cor			-
CodeBookS			0x0000 0000
iction bitmap			0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUSCH 3-1
Reporting interval		ms	5
PMI delay (Note 2)		ms	8
Measurement channel			R.44 FDD
OCNG Pattern			OP.1 FDD
Max number of HARQ			4
transm			r
Redundancy version			{0,1,2,3}
coding s	equence		(-1, 1, 1-)

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: PDSCH_RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.

Table 9.4.1.3.1-2: Minimum requirement (FDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

9.4.1.3.2 TDD

For the parameters specified in Table 9.4.1.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.2-2.

Table 9.4.1.3.2-1: PMI test for single-layer (TDD)

		11.29	
Parameter Randwidth		Unit MHz	Test 1
Bandwidth Transmission mode		MHZ	10
Transmission mode			9
Uplink downlink configuration			1
Special s configu			4
Propagation			EVA5
Precoding		PRB	50
Antenna co		7.1.2	8 x 2
Correlation			High, Cross
Cell-specifi			polarized Antenna ports
sigr			0,1 Antenna ports
CSI referer			15,,22
Beamform			Annex B.4.3
CSI-RS per subfram	e offset		5/ 4
CSI-RS r	Δcsi-Rs		
signal cor			0
CodeBookS iction t			0x0000 0000 001F FFE0 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$\rho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	dB	-6
	σ	dB	-3
N	(j)	dB[mW/15kHz]	-98
Reportin	na mode		PUSCH 3-1
Reporting		ms	5
	y (Note 2)	ms	10
			R.45-1 TDD for UE
Measureme	ent channel		Category 1, R.45 TDD for UE Category ≥2
			OP.7 TDD for
			UE Category
OCNG	Pattern		1, and OP.1
			TDD for UE
D.4	() A D O		Category ≥2
Max numbe transm	issions		4
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback			Multiplexing
Mode Note 1: For random p		l recoder selection, th	-
shall be updat		ted in each TTI (1 m	s granularity).
		orts in an available u	plink reporting
		brame SF#n based	
estimation at a down 4), this reported PM		a downlink SF not la ed PMI cannot be ap	iter than SF#(n-
	eNB downlink before SF#(n+4).		
		format 0 with a trigge	er for aperiodic ink SF#4 and #9
te		odic CQI/PMI/RI to b	

Note 4:	Randomization of the principle beam direction
	shall be used as specified in B.2.3A.4

Table 9.4.1.3.2-2: Minimum requirement (TDD)

Parameter	Test 1
γ	3
UE Category	≥1

9.4.1.3.3 FDD (with Class A 12Tx codebook)

For the parameters specified in Table 9.4.1.3.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.3-2.

Table 9.4.1.3.3-1: PMI test for single-layer (FDD)

Paramete	\r	Unit	Test 1
Parameter Randwidth		MHz	10
Bandwidth		IVII IZ	9
Transmission mode			EPA5
Propagation channel Precoding granularity		PRB	50
Correlation and		TIND	High 2D XP
configuration			12(2,3,2) x 2
Cell-specific referen			Antenna ports 0,1
			Antenna ports
CSI reference s	signais		15,,26
Beamforming			Annex B.4.3
CDM Typ			CDM2
CSI-RS periodic			
subframe of			5/ 1
T _{CSI-RS} / Δ _{CS}			(0.4.0)
NZP-CSI-RS-Config			{0,1,2}
eMIMO-Ty			Class A
codebookCon codebookCon			2 3
codebook-Over-S			<u> </u>
RateConfig-			8
codebook-Over-S			
RateConfig-			4
Codebook-Co			Note 5
			0x01
codebookSubsetRe	actriction 1		FFFF FFFF FFFF
CodebookSubsetive	25111011011-1		FFFF FFFF FFFF
			FFFF FFFF FFFF
			Codebook-Config 1:
codebookSubsetRe	estriction-2		0000 0000 1111
			Codebook-Config 2,3,4: 0x 00 000000 0000 FFFF
	<u> </u>		
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-8
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting m	ode		PUSCH 3-1
Reporting int		ms	5
PMI delay (No	ote 2)	ms	8
Measurement of			R.77 FDD
Rank Number of			11
OCNG Patt			OP.1 FDD
Max number of			4
transmissions			
Redundancy version coding sequence			{0,1,2,3}
		selection, the preco	der shall be updated in each TTI
(1 ms granularity).			
Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n			
based on PMI estimation at a downlink SF not later than SF#(n-4), this			
reported PMI cannot be applied at the eNB downlink before SF#(n+4). Note 3: PDSCH _RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH			
and OCNG power per subcarrier at the receiver.			
Note 4: Randomization of the principle beam direction shall be used as specified			
B.2.3B.4.			
-	Note 5: Value of parameter codebookConfig shall be random selected one value		
from UE supported codebook configurations.			

Table 9.4.1.3.3-2: Minimum requirement (FDD)

Parameter	Test 1
γ	2.5
UE Category	≥2

9.4.1.3.4 TDD (with Class A 12Tx codebook)

For the parameters specified in Table 9.4.1.3.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.3.4-2.

Table 9.4.1.3.4-1: PMI test for single-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
	Transmission mode		9
Uplink downlink co			1
Special subframe c			4
Propagation c			EPA5
Precoding gran		PRB	50
Correlation and		TIND	High 2D XP
configurati			12(2,3,2) x 2
Cell-specific refere			Antenna ports 0,1
			Antenna ports
CSI reference	signals		15,,26
Beamforming			Annex B.4.3
CDM Typ	е		CDM2
CSI-RS periodi	city and		
subframe of	ffset		5/ 4
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$			
NZP-CSI-RS-Con	figuration-		{0,1,2}
List			
eMIMO-Ty			Class A
codebookCon			2
codebookCon			3
codebook-Over-S RateConfig			8
codebook-Over-S RateConfig	Sampling-		4
Codebook-C			Note 5
codebookSubsetRestriction-1			0x01 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF
codebookSubsetR	codebookSubsetRestriction-2		Codebook-Config 1: 0000 0000 1111 Codebook-Config 2,3,4: 0x 00 000000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-8
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUSCH 3-1
Reporting interval		ms	5
PMI delay (Note 2)		ms	10
Measurement channel			R.77 TDD
Rank Number of PDSCH			1
OCNG Pattern			OP.1 TDD
Max number of HARQ			
transmission			4
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedb			Multiplexing
Note 1: For random precoder selection, the precoder shall be undated in each			

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.

Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3B.4.

Note 5:	Value of parameter codebookConfig shall be random selected one	
	value from UE supported codebook configurations.	

Table 9.4.1.3.4-2: Minimum requirement (TDD)

Parameter	Test 1
γ	2.5
UE Category	≥2

9.4.1.4 Minimum requirement PUCCH 1-1 (CSI Reference Symbol)

9.4.1.4.1 FDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.1.4.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.1-2.

Table 9.4.1.4.1-1 PMI test for single-layer (FDD)

Parama	tor	Unit	Toot 1
Parameter Bandwidth		Unit MHz	Test 1 10
Transmission mode		IVII IZ	9
Propagation channel			EPA5
Precoding gra		PRB	50
Correlation and			
configura			High XP 4 x 2
Beamforming	model		Annex B.4.3
Cell-specific re			Antenna ports 0,1
signals	5		<u> </u>
CSI reference	signals		Antenna ports 15,,18
CSI-RS period	icity and		
subframe o			5/ 1
$T_{\mathrm{CSI-RS}}$ / Δ_{C}			
CSI-RS referen			6
configura			
CodeBookSubse			0x0000 0000 0000
bitmap)		FFFF 0000 00FF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$	$N_{oc}^{(j)}$		-98
Reporting r	node		PUCCH 1-1 submode1
Reporting in		ms	5
PMI delay (I		ms	10
Physical channel for CQI/PMI reporting			PUSCH (Note 3)
PUCCH Report Type for CQI/second PMI			2b
Physical channel for RI			PUSCH
reporting			
PUCCH Report Type for RI/ first PMI			5
cqi-pmi-ConfigurationIndex			4
ri-ConfigIndex			1
Measurement			R.60 FDD
OCNG Pa	ttern		OP.1 FDD
Max number o			4
transmiss			
Redundancy version coding sequence			{0,1,2,3}
alternativeCodeBookEnable			_
dFor4TX-r12			True
Note 1: For random precoder selection, the precoder shall be updated			
in each TTI (1 ms granularity) Note 2: If the UE reports in an available uplink reporting instance at			
subrame SF#n based on PMI estimation at a downlink SF not			
later than SF#(n-4), this reported PMI cannot be applied at the			
eNB downlink before SF#(n+4).			
Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK			
it is necessary to report both on PUSCH instead of PUCCH			
Note 4: PDSCH_RA= 0 dB, PDSCH_RB= 0 dB in order to have the		IB in order to have the	
same PDSCH and OCNG power per subcarrier at the receive Note 5: Randomization of the principle beam direction shall be used			
	mization of treed in B.2.3A.		anection shall be used as
		· ·	

Table 9.4.1.4.1-2 Minimum requirement (FDD)

Parameter	Test 1
γ	1.8
UE Category	≥1

9.4.1.4.2 TDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.1.4.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.2-2.

Table 9.4.1.4.2-1 PMI test for single-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			9
Uplink downlink			1
configuration			1
Special sub			4
configura			•
Propagation of			EPA5
Precoding gra		PRB	50
Correlation and			High XP 4 x 2
configura			
Beamforming			Annex B.4.3
Cell-specific re signals			Antenna ports 0,1
			Antenna ports
CSI reference	signals		15,,18
CSI-RS period	icity and		10,,10
subframe of			5/ 4
$T_{\mathrm{CSI-RS}}$ / Δ_{C}			G/ 1
CSI-RS referen			
configura			6
CodeBookSubse			0x0000 0000 0000
bitmap			FFFF 0000 00FF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	dB	-3
		dB	-3
σ		-	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting r			PUCCH 1-1 submode1
Reporting in		ms	5
PMI delay (f		ms	15
Physical char CQI/PMI rep			PUSCH (Note 3)
PUCCH Repor	t Type for		2b
CQI/second	d PMI		20
Physical chann			PUSCH
reportin			
PUCCH Report Type for RI/ first PMI			5
cqi-pmi-ConfigurationIndex			4
ri-ConfigIndex			1
Measurement channel			R.60 TDD
OCNG Pattern			OP.1 TDD
Max number of HARQ			4
transmissions			4
	Redundancy version coding		{0,1,2,3}
sequent ACK/NACK feed			Multiplexing
alternativeCodeE			True
dFor4TX-			Πασ
Note 1: For random precoder selection, the precoder shall be updated			

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.

Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.

Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4.

Table 9.4.1.4.2-2 Minimum requirement (TDD)

Parameter	Test 1
γ	1.8
UE Category	≥1

9.4.1.4.3 FDD (with Class B alternative codebook for one CSI-RS resource configured)

For the parameters specified in Table 9.4.1.4.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.3-2.

Table 9.4.1.4.3-1 PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			9
Propagation channel			EPA5
Precoding gra		PRB	50
Correlation and	antenna		ULA Low 4 x 2
configurat			
Beamforming			Annex B.4.3
Cell-specific re signals			Antenna ports 0,1
CSI reference	signals		Antenna ports 15,,18
CSI-RS periodi	icity and		
subframe o	•		5/ 1
$T_{ m CSI ext{-}RS}$ / $\Delta_{ m C}$	SI-RS		
CSI-RS referen			6
configurat			6
eMIMO-Ty	уре		Class B
alternativeCodebo			
CLASSB_	_K1		TRUE
			00 0000 0000 0000 1111
codebookSubsetRestriction-3			1111
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-6
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting n	node		PUCCH 1-1
Reporting in		ms	5
PMI delay (N	lote 2)	ms	10
Physical channel f			PUSCH (Note 3)
reportin			1 33311 (11313 3)
PUCCH Report CQI/PN	11		2
Physical chann reporting			PUSCH
PUCCH Report Type for RI			3
cqi-pmi-ConfigurationIndex			2
ri-ConfigIndex			1
Measurement channel			R.45 FDD
Rank number of PDSCH		-	1
OCNG Pattern			OP.1 FDD
Max number o			4
transmissi			
Redundancy vers			{0,1,2,3}
sequenc			
	dom precode TI (1 ms gran		ecoder shall be updated in

If the UE reports in an available uplink reporting instance at Note 2: subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. Note 3:

PDSCH_RA= 0 dB, PDSCH_RB= 0 dB in order to have the same Note 4: PDSCH and OCNG power per subcarrier at the receiver.

Table 9.4.1.4.3-2 Minimum requirement (FDD)

Parameter	Test 1
γ	1.1
UE Category	≥2

9.4.1.4.4 TDD (with Class B alternative codebook for one CSI-RS resource configured)

For the parameters specified in Table 9.4.1.4.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.1.4.4-2.

Table 9.4.1.4.4-1 PMI test for single-layer (TDD)

Paramet	er	Unit	Test 1
Bandwidth		MHz	10
Transmission mode			9
Uplink downlink configuration			1
Special subf			,
configurat			4
Propagation c			EPA5
Precoding gra	nularity	PRB	50
Correlation and	antenna		ULA Low 8 x 2
configurat			OLA LOW 6 X 2
Beamforming			Annex B.4.3
Cell-specific refere	nce signals		Antenna ports 0,1
CSI reference	signals		Antenna ports 15,,22
CSI-RS periodi	city and		-, ,
subframe o			5/ 4
$T_{\text{CSI-RS}}$ / Δ_{C}			
CSI-RS referen			0
configurat			0
eMIMO-Ty	/ре		Class B
alternativeCodebo			
	CLASSB_K1		TRUE
codebookSubsetR	estriction-3		0x 000 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting n	node		PUCCH 1-1
Reporting in		ms	5
PMI delay (N		ms	10
Physical channel f			DUICOUL (NI-t- O)
reporting	g		PUSCH (Note 3)
PUCCH Report Ty PMI	pe for CQI/		2
Physical chann			PUSCH
reporting			
PUCCH Report Type for RI			3
cqi-pmi-ConfigurationIndex			4
ri-ConfigIndex			805 D 45 TDD
Measurement channel			R.45 TDD
Rank number of PDSCH			1 OD 1 TDD
OCNG Pat Max number o			OP.1 TDD
transmissi			4
Redundancy vers			(0.1.2.2)
sequenc			{0,1,2,3}
ACK/NACK feedb			Multiplexing
Note 1: For random precoder selection, the precoder shall be updated in			

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH.

Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.

Table 9.4.1.4.4-2 Minimum requirement (TDD)

Parameter	Test 1
γ	1.2
UE Category	≥2

9.4.1a Void

9.4.1a.1 Void

9.4.1a.1.1 Void

9.4.1a.1.2 Void

9.4.2 Multiple PMI

9.4.2.1 Minimum requirement PUSCH 1-2 (Cell-Specific Reference Symbols)

9.4.2.1.1 FDD

For the parameters specified in Table 9.4.2.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.1-2.

Table 9.4.2.1.1-1: PMI test for single-layer (FDD)

Parar	neter	Unit	Test 1
Bandwidth		MHz	10
Transmiss		=	6
Propagation			EPA5
	granularity	PRB	6
followin			
Correlate antenna co			Low 2 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-3
power	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reportir	ng mode		PUSCH 1-2
Reporting interval		ms	1
PMI delay		ms	8
Measurement channel			R.11-3 FDD for UE Category 1, R.11 FDD for UE Category ≥2
OCNG Pattern			OP.1/2 FDD
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
Note 1: For random precoder selection, the precoders shall be updated in each TTI (1 ms granularity). Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-			

4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

One/two sided dynamic OCNG Pattern OP.1/2

Note 3: FDD as described in Annex A.5.1.1/2 shall be used.

Table 9.4.2.1.1-2: Minimum requirement (FDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

9.4.2.1.2 **TDD**

For the parameters specified in Table 9.4.2.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.1.2-2.

Table 9.4.2.1.2-1: PMI test for single-layer (TDD)

Para	meter	Unit	Test 1
Bandwidth		MHz	10
Transmission mode			6
	downlink		1
	uration		<u> </u>
	subframe		4
	uration		
	on channel granularity		EPA5
(only for re	porting and	PRB	6
	ng PMI)		
	tion and onfiguration		Low 2 x 2
antenna co		dB	-3
Downlink	$ ho_{\scriptscriptstyle A}$	αь	-3
power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3
allocation	σ	dB	0
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting mode			PUSCH 1-2
Reporting interval		ms	1
PMI	delay	ms	10 or 11
Measurement channel			R.11-3 TDD for UE Category 1 R.11 TDD for UE Category ≥2
OCNG Pattern			OP.1/2 TDD
Max numb	er of HARQ		4
	issions		
	icy version equence		{0,1,2,3}
	K feedback		Multiplexing
mode			. •
Note 2:	shall be updated in each available downlink transmission instance.		
Note 3: 0	4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).		

Table 9.4.2.1.2-2: Minimum requirement (TDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

9.4.2.2 Minimum requirement PUSCH 2-2 (Cell-Specific Reference Symbols)

9.4.2.2.1 FDD

For the parameters specified in Table 9.4.2.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.1-2.

Table 9.4.2.2.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			6
Propagation	on channel		EVA5
	tion and onfiguration		Low 4 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6
power	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
N	(j) oc	dB[mW/15kHz]	-98
PMI (delay	ms	8
	ng mode		PUSCH 2-2
Reporting	g interval	ms	1
Measureme	ent channel		R.14-2 FDD
OCNG	Pattern		OP.1/2 FDD
Subband	d size (<i>k</i>)	RBs	3 (full size)
Number of preferred subbands (M)			5
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4)

Table 9.4.2.2.1-2: Minimum requirement (FDD)

	Test 1
γ	1.2
UE Category	≥1

9.4.2.2.2 TDD

For the parameters specified in Table 9.4.2.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.2.2-2.

Table 9.4.2.2.2-1: PMI test for single-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmiss	sion mode		6
	lownlink		1
	uration		·
	subframe		4
	uration		·
	on channel		EVA5
	tion and onfiguration		Low 4 x 2
Downlink	$ ho_{\scriptscriptstyle A}$	dB	-6
power	$ ho_{\scriptscriptstyle B}$	dB	-6
allocation	σ	dB	3
N	(j) oc	dB[mW/15kHz]	-98
PMI (delay	ms	10
Reportir	ng mode		PUSCH 2-2
Reporting	g interval	ms	1
	ent channel		R.14-2 TDD
	Pattern		OP.1/2 TDD
	d size (<i>k</i>)	RBs	3 (full size)
Number of preferred			5
subbands (M)			
Max number of HARQ			4
transmissions			
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedback mode			Multiplexing
mc		1 1 6 6	

Note 1: For random precoder selection, the precoders shall be updated in each available downlink transmission instance.

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Table 9.4.2.2.2-2 Minimum requirement (TDD)

	Test 1
γ	1.15
UE Category	≥1

9.4.2.3 Minimum requirement PUSCH 1-2 (CSI Reference Symbol)

9.4.2.3.1 FDD

For the parameters specified in Table 9.4.2.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.1-2.

Table 9.4.2.3.1-1: PMI test for single-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			9
Propagation			EVA5
	granularity porting and ng PMI)	PRB	6
Correlate antenna co	tion and		Low ULA 4 x 2
Cell-specifi sigr			Antenna ports 0,1
CSI refere			Antenna ports 15,,18
Beamform			Annex B.4.3
T _{CSI-RS}	ne offset ∕ ∆csi-Rs		5/ 1
CSI-RS r signal cor	nfiguration		8
CodeBookS iction I			0x0000 0000 0000 FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
N_{i}		dB[mW/15kHz]	-98
Reportir			PUSCH 1-2
Reporting		ms	5
PMI (delay	ms	8
Measurement channel			R.45-1 FDD for UE Category 1, R.45 FDD for UE Category ≥2
OCNG Pattern			OP.7 FDD for UE Category 1 OP.1 FDD for UE Category ≥2
Max number			4
Redundan coding s	cy version		{0,1,2,3}

Note 1: For random precoder selection, the precoders shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the

eNB downlink before SF#(n+4).

Note 3: Void.

Note 4: PDSCH _RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per

subcarrier at the receiver.

Table 9.4.2.3.1-2: Minimum requirement (FDD)

Parameter	Test 1
γ	1.3
UE Category	≥1

9.4.2.3.2 TDD

For the parameters specified in Table 9.4.2.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.2-2.

Table 9.4.2.3.2-1: PMI test for single-layer (TDD)

D		1111	T14
Parameter Bandwidth		Unit MHz	Test 1
Transmission mode		IVITZ	10 9
Uplink downlink			-
configu			1
Special s			
configu			4
Propagation			EVA5
Precoding			
(only for rep		PRB	6
followin			
Antenna co	nfiguration		8 x 2
Correlation	modeling		High, Cross polarized
Cell-specific	reference		Antenna ports
sigr			0,1
•			Antenna ports
CSI referer	nce signals		15,,22
Beamform	ing model		Annex B.4.3
CSI-RS per	•		
subfram			5/ 4
T _{CSI-RS} /			
CSI-RS r			4
signal con	iliguration		0x0000 0000
CodeBookS	SubsetRestr		001F FFE0
iction b			0000 0000
	ар		FFFF
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$\rho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	db	-6
allocation		dB	-3
	σ (;)	αВ	-3
N_{c}) (J)	dB[mW/15kHz]	-98
Reportin			PUSCH 1-2
Reporting		ms	5 (Note 4)
PMI	delay	ms	10
			R.45-1 TDD
			for UE Category 1,
Measureme	ent channel		R.45 TDD for
			UE Category
			≥2
			OP.7 TDD for
			UE Category 1
OCNG	Pattern		OP.1 TDD for
			UE Category
Marrier	(I I A D O		≥2
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
ACK/NACk			B. A. J. C. L. C.
mo			Multiplexing
		recoder selection, th	
		ted in each TTI (1 m	
Note 2: If the UE reports in an available uplink reporting			

instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the

eNB downlink before SF#(n+4).

Note 3: Void.

Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted

on uplink SF#3 and #8.

Note 5: Randomization of the principle beam direction

shall be used as specified in B.2.3A.4.

Table 9.4.2.3.2-2: Minimum requirement (TDD)

Parameter	Test 1
γ	3.5
UE Category	≥1

9.4.2.3.3 FDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.2.3.3-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.3-2.

Table 9.4.2.3.3-1 PMI test for dual-layer (FDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			9
	Propagation channel		EVA5
Precoding gra			
(only for repor	ting and	PRB	6
following I			
Correlation and			High XP 4 x 2
configura Beamforming			Annex B.4.3
Cell-specific re			ATTITEX D.4.3
signals			Antenna ports 0,1
			Antenna ports
CSI reference	signals		15,,18
CSI-RS period	icity and		, ,
subframe offset	T _{CSI-RS}		5/ 1
/ I _{CSI-RS}			
CSI-RS referen			8
configura			-
CodeBookSubse			0x0000 0000 FFFF
bitmap)		0000 FFFF 0000
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting r	node		PUSCH1-2
Reporting in		ms	5
PMI delay (f	Note 2)	ms	8
			R.45-1 FDD for UE
Measurement	channel		Category 1, R.45 FDD
			for UE Category ≥2
Rank Number of PDSCH			2
			OP.7 FDD for UE
OCNG Pa	ttern		Category 1 OP.1 FDD for UE
			Category ≥2
Max number of HARQ			
transmiss			4
Redundancy vers			(0.4.2.2)
sequen	ce		{0,1,2,3}
alternativeCodeE	ookEnable		True
dFor4TX-	r12		

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: Void.

Note 4: PDSCH_RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.

Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4

Table 9.4.2.3.3-2 Minimum requirement (FDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

9.4.2.3.4 TDD (with 4Tx enhanced codebook)

For the parameters specified in Table 9.4.2.3.4-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in 9.4.2.3.4-2.

Table 9.4.2.3.4-1 PMI test for dual-layer (TDD)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Transmission mode			9
Uplink dow			1
configura			'
Special sub			4
configurat			-
Propagation of			EVA5
Precoding gra (only for repor following F	ting and	PRB	6
Correlation and	antenna		XP High 4 x 2
configurat			
Beamforming			Annex B.4.3
Cell-specific re			Antenna ports 0,1
CSI reference	signals		Antenna ports 15,,18
CSI-RS period subframe offset / Icsi-RS	T _{CSI-RS}		5/ 4
CSI-RS referen			4
CodeBookSubset bitmap			0x0000 0000 FFFF 0000 FFFF 0000
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink	$ ho_{\scriptscriptstyle B}$	dB	0
power allocation	Pc	dB	-3
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
Reporting r	node		PUSCH1-2
Reporting in		ms	5
PMI delay (N	Note 2)	ms	10
Measurement	Measurement channel		R.61-1 TDD for UE Category 1, R.61 TDD for UE Category ≥2
Rank Number o	f PDSCH		2
OCNG Pattern			OP.7 FDD for UE Category 1 OP.1 FDD for UE Category ≥2
Max number of HARQ transmissions			4
Redundancy version coding sequence			{0,1,2,3}
ACK/NACK feedl			Multiplexing
alternativeCodeB dFor4TX-	ookEnable r12		True
Note 1: For random precoder selection, the precoder shall be undated			

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity)

Note 2: If the UE reports in an available uplink reporting instance at

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note3: Void.

Note 4: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to be transmitted on uplink SF#3 and #8.

Note 5: Randomization of the principle beam direction shall be used as specified in B.2.3A.4.

Table 9.4.2.3.4-2 Minimum requirement (TDD)

Parameter	Test 1
γ	1.2
UE Category	≥1

9.4.2.3.5 FDD (with Class A 16Tx codebook)

For the parameters specified in Table 9.4.2.3.5-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.3.5-2.

Table 9.4.2.3.5-1: PMI test for dual-layer (FDD)

Paramete	r	Unit	Test 1		
Bandwidth	า	MHz	10		
Transmission i			9		
Propagation ch			EVA5		
Precoding gran (only for reporting ar PMI)		PRB	6		
Correlation and a			High 2D XP		
configuration			16(2,4,2) x 2		
Cell-specific referen	ice signals		Antenna ports 0,1		
CSI reference s	ignals		Antenna ports 15,,30		
Beamforming r			Annex B.4.3		
CDM Type			CDM4		
CSI-RS periodic subframe off $T_{\text{CSI-RS}}$ / Δ_{CS}	set		5/ 1		
NZP-CSI-RS-Config			{0,1}		
eMIMO-Typ			Class A		
codebookConf			2		
codebookConf			4		
codebook-Over-S			·		
RateConfig-	01		8		
codebook-Over-S RateConfig-			8		
Codebook-Co			Note 5		
codebookSubsetRestriction-1			0x02 FFFF FFFF FFFF FFFF FFFF FFFF FFFF		
codebookSubsetRe	estriction-2		Codebook-Config 1: 0000 1111 0000 Codebook-Config 2,3,4: 0x 00 000000 FFFF 0000		
Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0		
	$ ho_{\scriptscriptstyle B}$	dB	0		
	Pc	dB	-6		
	σ	dB	-3		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98		
Reporting me			PUSCH 1-2		
Reporting into		ms	5		
PMI delay (Note 2)		ms	8		
Measurement channel			R.78 FDD		
Rank Number of PDSCH			2		
	OCNG Pattern		OP.1 FDD		
Max number of transmissio			4		
Redundancy version sequence	on coding		{0,1,2,3}		
Note 1: For random precoder selection, the precoder shall be updated in each TTI					

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 3: PDSCH_RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.

Note 4:	Randomization of the principle beam direction shall be used as specified in
	B.2.3B.4.
Note 5:	Value of parameter codebookConfig shall be random selected one value
	from LIF supported codebook configurations

Table 9.4.2.3.5-2: Minimum requirement (FDD)

Parameter	Test 1
γ	2.5
UE Category	≥2

9.4.2.3.6 TDD (with Class A 16Tx codebook)

For the parameters specified in Table 9.4.2.3.6-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.4.2.3.6-2.

Table 9.4.2.3.6-1: PMI test for dual-layer (TDD)

Paramete	er	Unit	Test 1
Bandwidt	th	MHz	10
Transmission	mode		9
Uplink downlink co	nfiguration		1
Special subframe c	onfiguration		4
Propagation c	hannel		EVA5
Precoding grain	nularity		
(only for report	ing and	PRB	6
following P	MI)		
Correlation and	antenna		High 2D XP
configurati			16(2,4,2) x 2
Cell-specific refere	nce signals		Antenna ports 0,1
CSI reference	signals		Antenna ports 15,,26
Beamforming	model		Annex B.4.3
CDM Typ			CDM4
CSI-RS periodi			OBINIT
subframe of			5/ 4
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$			5 / 1
NZP-CSI-RS-Con			
List			{0,1}
eMIMO-Ty	rpe		Class A
codebookCon			2
codebookCon			4
codebook-Over-S	Sampling-		8
RateConfig	-01		0
codebook-Over-S			8
RateConfig			-
Codebook-C	onfig		Note 5
codebookSubsetRestriction-1			0x02 FFFF FFFF FFFF FFFF FFFF FFFF FFFF FF
codebookSubsetR	estriction-2		Codebook-Config 1: 0000 1111 0000 Codebook-Config 2,3,4: 0x 00 000000 FFFF 0000
	$ ho_{\scriptscriptstyle A}$	dB	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0
allocation	Pc	dB	-6
	σ	dB	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98
	Reporting mode		PUSCH 1-2
Reporting interval		ms	5
PMI delay (Note 2)		ms	10
Measurement channel			R.78 TDD
Rank Number of PDSCH			2
OCNG Pattern			OP.1 TDD
Max number of			
transmissio			4
Redundancy vers sequence	ion coding		{0,1,2,3}
ACK/NACK feedb			Multiplexing
		a ala atia a tha a a a a	der shall be undated in each

Note 1: For random precoder selection, the precoder shall be updated in each TTI (1 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-

4), this reported PMI cannot be applied at the eNB downlink before	

SF#(n+4).

Note 3: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be

transmitted in downlink SF#4 and #9 to allow aperiodic CQI/PMI/RI to

be transmitted on uplink SF#3 and #8.

Note 4: Randomization of the principle beam direction shall be used as

specified in B.2.3B.4

Note 5: Value of parameter codebookConfig shall be random selected one

value from UE supported codebook configurations.

Table 9.4.2.3.6-2: Minimum requirement (TDD)

Parameter	Test 1
γ	2.5
UE Category	≥2

9.4.3 Void

9.4.3.1 Void

9.4.3.1.1 Void

9.4.3.1.2 Void

9.5 Reporting of Rank Indicator (RI)

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI (CQI) reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission. Transmission mode 4 is used with the specified CodebookSubSetRestriction in section 9.5.1, transmission mode 9 is used with the specified CodebookSubSetRestriction in section 9.5.2 and transmission mode 3 is used with the specified CodebookSubSetRestriction in section 9.5.3, and transmission mode 10 is used with the specified CodebookSubSetRestriction in section 9.5.5.

For fixed rank 1 transmission in sections 9.5.1, 9.5.2 and 9.5.5, the RI and PMI reporting is restricted to two single-layer precoders, For fixed rank 2 transmission in sections 9.5.1, 9.5.2 and 9.5.5, the RI and PMI reporting is restricted to one two-layer precoder, For follow RI transmission in sections 9.5.1 and 9.5.2, the RI and PMI reporting is restricted to select the union of these precoders. Channels with low and high correlation are used to ensure that RI reporting reflects the channel condition.

For fixed rank 1 transmission in section 9.5.3, the RI reporting is restricted to single-layer, for fixed rank 2 transmission in section 9.5.3, the RI reporting is restricted to two-layers. For follow RI transmission in section 9.5.3, the RI reporting is either one or two layers.

9.5.1 Minimum requirement (Cell-Specific Reference Symbols)

9.5.1.1 FDD

The minimum performance requirement in Table 9.5.1.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.5.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.1-2.

Table 9.5.1.1-1: RI Test (FDD)

Parameter		Unit	Test 1 Test 2 Test 3			
Bandwidth		MHz	MHz 10			
PDSCH transmission mode				4		
$\rho_{\scriptscriptstyle A}$		dB		-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-3		
	σ	dB		0		
Propagation condit antenna configur				2 x 2 EPA5		
CodeBookSubsetRe bitmap	estriction		01000	11 for fixed RI = 1 00 for fixed RI = 2 for UE reported	2	
Antenna correla	ation		Low	Low	High	
RI configuration	on		Fixed RI=2 and Fixed RI=1 Fixed		Fixed RI=1 and follow RI	
SNR		dB	0	20	20	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78	
Maximum number of transmission				1		
Reporting mo	de		PUC	CH 1-1 (Note 4)		
Physical channel for CQI/PMI reporting			PU	JCCH Format 2		
PUCCH Report Type for CQI/PMI			2			
Physical channel for RI reporting			PUSCH (Note 3)			
PUCCH Report Type for RI		3				
Reporting periodicity		ms	N _{pd} = 5			
PMI and CQI d		ms		8		
cqi-pmi-Configurati				6		
ri-Configuration	nInd		1 (Note 5)			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between RI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 4: The bit field for precoding information in DCI format 2 shall be mapped as:
 - For reported RI = 1 and PMI = 0 >> precoding information bit field index = 1
 - For reported RI = 1 and PMI = 1 >> precoding information bit field index = 2
 - For reported RI = 2 and PMI = 0 >> precoding information bit field index = 0
- Note 5: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.

Table 9.5.1.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3
21	N/A	1.05	0.9
72	1	N/A	N/A
UE Category	≥2	≥2	≥2

9.5.1.2 TDD

The minimum performance requirement in Table 9.5.1.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.5.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.1.2-2.

Table 9.5.1.2-1: RI Test (TDD)

Parameter		Unit	Test 1 Test 2 Test 3			
Bandwidth		MHz	10			
PDSCH transmission	on mode		4			
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB		-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-3		
	σ	dB	0			
Uplink downlink conf				2		
Special subfra configuration	า			4		
Propagation condit antenna configur				2 x 2 EPA5		
CodeBookSubsetRe	estriction			11 for fixed RI = 1		
bitmap			010000 for fixed RI = 2 010011 for UE reported RI			
Antenna correla	ation		Low	Low	High	
RI configuration	on		Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI	
SNR		dB	0	20	20	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$ dB[mW/15kHz]		-98	-78	-78	
Maximum number of transmission			1			
Reporting mo	Reporting mode		PUSCH 3-1 (Note 3)			
Reporting interval		ms	5			
PMI and CQI de	elay	ms	10 or 11			
ACK/NACK feedbac	ck mode		Bundling			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: Reported wideband CQI and PMI are used and sub-band CQI is discarded.

Table 9.5.1.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3
<i>γ</i> 1	N/A	1.05	0.9
72	1	N/A	N/A
UE Category	≥2	≥2	≥2

9.5.2 Minimum requirement (CSI Reference Symbols)

9.5.2.1 FDD

The minimum performance requirement in Table 9.5.2.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.5.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.1-2.

Table 9.5.2.1-1: RI Test (FDD)

Parameter		Unit	Test 1 Test 2 Test 3		Test 3		
Bandwidth		MHz		10			
PDSCH transmission	n mode		9				
	$ ho_{\scriptscriptstyle A}$	dB	0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0			
allocation Pc		dB		0			
	σ	dB	0				
Propagation condit				2 x 2 EPA5			
antenna configur			Λ.	-1			
Cell-specific reference				ntenna ports 0	4.0		
Beamforming M				fied in Section B.	4.3		
CSI reference signification CSI-RS periodicities			Ante	nna ports 15, 16			
subframe offs $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$	et			5/1			
CSI reference si	ignal			6			
CodeBookSubsetRestriction bitmap			000011 for fixed RI = 1 010000 for fixed RI = 2 010011 for UE reported RI		2		
Antenna correla	ation		Low	Low	High		
RI configuration	on		Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI		
SNR		dB	0	20	20		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98		
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78		
Maximum number o				1			
Reporting mo	de			PUCCH 1-1			
Physical channel for	CQI/PMI		Pl	JSCH (Note 3)			
reporting							
PUCCH Report Ty CQI/PMI	•		2				
Physical channel for RI reporting			PUCCH Format 2				
PUCCH Report Type for RI			3				
Reporting period	dicity	ms	$N_{\rm pd} = 5$				
PMI and CQI de	elay	ms		8			
cqi-pmi-Configurati			2				
ri-Configuration			-	1 (Note 4)			
Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and							

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.9 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5
- Note 4: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.

Table 9.5.2.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3
21	N/A	1.05	0.9
72	1	N/A	N/A
UE Category	≥2	≥2	≥2

9.5.2.2 TDD

The minimum performance requirement in Table 9.5.2.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.5.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.2.2-2.

Table 9.5.2.2-1: RI Test (TDD)

Parameter		Unit	Test 1 Test 2 Test 3		
Bandwidth	Bandwidth			10	
PDSCH transmission	on mode			9	
	$ ho_{\scriptscriptstyle A}$	dB		0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB		0	
allocation	Pc	dB	0		
	σ	dB		0	
Uplink downlink con	_	-		1	
Special subfra				4	
configuration				4	
Propagation condit	ion and			2 x 2 EPA5	
antenna configu				ZXZEFAO	
Cell-specific reference				ntenna ports 0	
CSI reference si				enna ports 15, 16	
Beamforming M			As spec	ified in Section B.	4.3
CSI reference s configuration				4	
CSI-RS periodicit					
subframe offs				5/4	
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-I}}$				3/4	
	-		000011 for fixed RI = 1		
CodeBookSubsetRe	estriction			00 for fixed $RI = 2$	
bitmap			010011 for UE reported RI		
Antenna correla	ation		Low	Low	High
RI configuration	on		Fixed RI=2 and	Fixed RI=1	Fixed RI=1
	OH		follow RI	and follow RI	and follow RI
SNR		dB	0	20	20
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-78	-78
Maximum number of				1	1
transmission					
Reporting mo				PUCCH 1-1	
Physical channel for	CQI/ PMI		Pl	JSCH (Note 3)	
reporting PUCCH report type	for COI/				
POCCH report type PMI	IOI CQI/		2		
Physical channel	for RI		PUCCH Format 2		
reporting Reporting period	dicity	ms	N 5		
PMI and CQI d			N _{pd} = 5 10		
ACK/NACK feedba		ms			
cqi-pmi-Configurati			Bundling		
ri-Configuration				4 1	
		availahle unlink rer	oorting instance at sul	-	ed on PMI and

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.9 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#3 and #8.

Table 9.5.2.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3
71	N/A	1.05	0.9
γ2	1	N/A	N/A
UE Category	≥2	≥2	≥2

9.5.3 Minimum requirement (CSI measurements in case two CSI subframe sets are configured)

9.5.3.1 FDD

The minimum performance requirement in Table 9.5.3.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$

For the parameters specified in Table 9.5.3.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.1-2.

Table 9.5.3.1-1: RI Test (FDD)

Doromotor		Unit	To	est 1	Tes	st 2
Parameter			Cell 1	Cell 2	Cell 1	Cell 2
Bandwidth	n mada	MHz	3	10 Note 10	3	
PDSCH transmission		dB	3		<u> </u>	Note 10
Downlink power	$\rho_{\scriptscriptstyle A}$			-3		
allocation	$ ho_{\scriptscriptstyle B}$	dB		-3	-:	
Propagation conditi	on and	dB		0	(
antenna configur			2 x 2	2 EPA5	2 x 2	EPA5
CodeBookSubsetRestriction bitmap			01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A	01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A
Antenna correla	tion			_ow	Lo	w
RI configuration	on		Fixed RI=1 and follow RI	N/A	Fixed RI=1 and follow RI	N/A
\widehat{E}_s/N_{oc2}		dB	0	-12	20	6
	$N_{oc1}^{(j)}$		-98 (Note 3)	N/A	-102 (Note 3)	N/A
$N_{oc}^{(j)}$	$N_{\rm oc2}^{(j)}$	dBmW/15kH z	-98 (Note 4)	N/A	-98 (Note 4)	N/A
	$N_{\rm oc3}^{(j)}$		-98 (Note 5)	N/A	-94.8 (Note 5)	N/A
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$		-98	-110	-78	-92
Subframe Configu	ration		Non- MBSFN	Non-MBSFN	Non-MBSFN	Non-MBSFN
Cell Id			0	1	0	1
Time Offset between		μѕ	2.5 (synch	10000000 10000000 10000000 10000000 1000000	2.5 (synchro	1000000 1000000 1000000 1000000 1000000
RLM/RRM Measur Subframe Pattern (1000000 1000000 1000000 1000000 1000000	N/A	10000000 10000000 10000000 10000000 1000000	N/A
CSI Subframe Sets (Note 8)	Ccsi,0		10000000 10000000 10000000 10000000 1000000	N/A	10000000 10000000 10000000 10000000 1000000	N/A
Number of control Symbols	OFDM		3	3	3	3
Maximum number o				1	1	
transmission: Reporting mod			חווס	CH 1-0	PUCC	
Physical channel for reporting				Format 2		Format 2
PUCCH Report Type	e for CQI			4		<u> </u>
. ,					-	

Physical	channel for RI reporting		PUCCH Format 2		PUCCH Format 2	
PUCC	CH Report Type for RI		3		3	
Re	eporting periodicity	ms	N _{pd} =	= 10	N _{pd} =	= 10
cqi-pi	mi-ConfigurationIndex		1	1	1	1
ri	i-ConfigurationInd		5	5		5
cqi-pn	ni-ConfigurationIndex2		1	0	1	0
ri-	-ConfigurationInd2		2	2	2	2
	Cyclic prefix		Normal	Normal	Normal	Normal
Note 1:	If the UE reports in an ava a downlink subframe not downlink before SF#(n+4	: later than SF#(4).	n-4), this report	ted wideband (CQI cannot be app	lied at the eNB
Note 2:	Reference measuremen OCNG Pattern OP.1 FD			•	ble A.4-1 with one	sided dynamic
Note 3:	Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.					frame
Note 4:	Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.					
Note 5: Note 6:	1					n-ABS
Note 7:					ned in [7].	

measurements defined in [7].

Note 9: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same.

As configured according to the time-domain measurement resource restriction pattern for CSI

Note 10: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.1.5.

Table 9.5.3.1-2: Minimum requirement (FDD)

	Test 1	Test 2
<i>7</i> 1	0.9	1.05
UE Category	≥2	≥2

9.5.3.2 TDD

Note 8:

The minimum performance requirement in Table 9.5.3.2-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$.

For the parameters specified in Table 9.5.3.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.3.2-2.

Table 9.5.3.2-1: RI Test (TDD)

Parameter		Unit	Tes	st1	Test2		
			Cell 1	Cell 2	Cell 1	Cell 2	
Bandwidth		MHz	3	•	10		
PDSCH transmission Uplink downlink conf			<u> </u>	Note 11	3	Note 11	
Special subfra					4		
configuration	1						
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	-(3	-3	3	
allocation	$ ho_{\scriptscriptstyle B}$	dB	-3		-3		
Propagation condit	σ	dB	С)	0	1	
antenna configui			2 x 2 l	EPA5	2 x 2 E	EPA5	
CodeBookSubsetRe bitmap	estriction		01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A	01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	N/A	
Antenna correla	ation		Lo	W	Lo	W	
RI configuration			Fixed RI=1 and follow RI	N/A	Fixed RI=1 and follow RI	N/A	
\widehat{E}_s/N_{oc2}		dB	0	-12	20	6	
	$N_{oc1}^{(j)}$		-98 (Note 4)	N/A	-102 (Note 4)	N/A	
$N_{oc}^{(j)}$	$N_{\rm oc2}^{(j)}$	dB[mW/15k Hz]	-98 (Note 5)	N/A	-98 (Note 5)	N/A	
	$N_{oc3}^{(j)}$		-98 (Note 6)	N/A	-94.8 (Note 6)	N/A	
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	-98	-110	-78	-92	
Subframe Configu	uration		Non- MBSFN	Non- MBSFN	Non-MBSFN	Non-MBSFN	
Cell Id			0 2.5 (sync	hronous	0 1		
Time Offset between	en Cells	μs	z.o (sync		2.5 (synchro	nous cells)	
ABS Pattern (No	ote 7)		N/A	0000000 001 0000000 001	N/A	000000001 000000001	
RLM/RRM Measu Subframe Pattern (00000000 01 00000000 01	N/A	0000000001 0000000001	N/A	
CSI Subframe Sets	Ccsi,o		00000000 01 00000000 01	N/A	0000000001 0000000001	N/A	
(Note 9)	C _{CSI,1}		11001110 00 11001110 00		1100111000 1100111000	14/73	
Number of control Symbols	OFDM		3	3	3	3	
Maximum number of			1		1		
transmission							
Reporting mo			PUCC		PUCC		
and RI reporti	ng		PUCCH I	Format 2	PUCCH	Format 2	
PUCCH Report Type	e for CQI		4		4	4	

Physical channel for C _{CSI,1} CQI and RI reporting		PUSCH (Note 3)		PUSCH	(Note 3)
PUCCH Report Type for RI		;	3	3	3
Reporting periodicity	ms	<i>N</i> _{pd} = 10		N _{pd} = 10	
ACK/NACK feedback mode		Multiplexing		Multiplexing	
cqi-pmi-ConfigurationIndex		8		8	
ri-ConfigurationInd		Į.	5	5	
cqi-pmi-ConfigurationIndex2		9		9	
ri-ConfigurationInd2		0		()
Cyclic prefix		Normal	Normal	Normal	Normal

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 4: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS
- Note 5: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 6: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 7: ABS pattern as defined in [9].
- Note 8: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7].
- Note 9: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 10: Cell 1 is the serving cell. Cell 2 is the aggressor cell. The number of the CRS ports in Cell 1 and Cell 2 is the same.
- Note 11: Downlink physical channel setup in Cell 2 in accordance with Annex C.3.3 applying OCNG pattern as defined in Annex A.5.2.5.

Table 9.5.3.2-2: Minimum requirement (TDD)

	Test 1	Test 2
γι	0.9	1.05
UE Category	≥2	≥2

9.5.4 Minimum requirement (CSI measurements in case two CSI subframe sets are configured and CRS assistance information are configured)

9.5.4.1 FDD

For the parameters specified in Table 9.5.4.1-1, the minimum performance requirement in Table 9.5.4.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_{1}$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

In Table 9.5.4.1-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 9.5.4.1-1: RI Test (FDD)

Parameter		Unit	Cell 1	Cell 2	Cell 3
Bandwidth		MHz	10	10	10
PDSCH transmissio	n mode		3	As defined in Note 1	As defined in Note 1
	$ ho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
	σ	dB	0	N/A	N/A
Propagation conditi antenna configura			2x2 EPA5 (Note 2)	2x2 EPA5 (Note 2)	2×2 EPA5 (Note 2)
CodeBookSubsetRe bitmap			01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	As defined in Note 1	As defined in Note 1
	N_{oc1}	dB[mW/15k Hz]	-98 (Note 3)	N/A	N/A
N_{oc} at antenna port	N_{oc2}	dB[mW/15k Hz]	-98 (Note 4)	N/A	N/A
	N_{oc3}	dB[mW/15k Hz]	-93 (Note 5)	N/A	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 9.5.4.1-2 for each test	12	10
$\hat{I}_{or}^{(j)}$		dB[mW/15k Hz]	Reference Value in Table 9.5.4.1-2 for each test	-86	-88
Subframe Configu	ration		Non-MBSFN	Non-MBSFN	Non-MBSFN
Time Offset betwee	Time Offset between Cells		N/A	3	-1
Frequency shift between	Frequency shift between Cells		N/A	300	-100
Cell Id			0	126	1
ABS pattern (No	te 6)		N/A	1000000 1000000 1000000 1000000 1000000	1000000 1000000 1000000 1000000 1000000
RLM/RRM Measur Subframe Pattern (I			10000000 10000000 10000000 10000000	N/A	N/A
CSI Subframe Sets	Ccsi,0		10000000 10000000 10000000 10000000 1000000	N/A	N/A
(Note 8)	Ccsi,1		01111111 01111111 01111111 01111111 0111111	N/A	N/A
Number of control symbols	OFDM		3	Note 9	Note 9
Maximum number o			1	N/A	N/A
Reporting mod			PUCCH 1-0	N/A	N/A
Physical channel for			PUCCH format 2	N/A	N/A
reporting PUCCH Report Type	for COL		4	N/A	N/A
Physical channel for R			PUCCH Format 2	N/A	N/A
PUCCH Report Typ			3	N/A	N/A
Reporting period		ms	N _{pd} = 10	N/A	N/A

-						
	ni-ConfigurationIndex		11	N/A	N/A	
ri-	ri-ConfigurationInd		5	N/A	N/A	
cqi-pm	i-ConfigurationIndex2		10	N/A	N/A	
ri-0	ConfigurationInd2		2	N/A	N/A	
	Cyclic prefix		Normal	Normal	Normal	
Note 1:	Downlink physical chan	nel setup in Cell	2 and Cell 3 in accor	rdance with Annex	C.3.3 applying	
	OCNG pattern OP.5 FD	D as defined in	Annex A.5.1.5.			
Note 2:	The propagation conditi	ons for Cell 1, C	ell 2 and Cell 3 are s	tatistically indeper	ndent.	
Note 3:	This noise is applied in	OFDM symbols	#1, #2, #3, #5, #6, #8	3, #9, #10,#12, #1	3 of a subframe	
	overlapping with the age					
Note 4:	This noise is applied in	OFDM symbols	#0, #4, #7, #11 of a s	subframe overlapp	ing with the	
	aggressor ABS.					
Note 5:	This noise is applied in					
Note 6:	ABS pattern as defined					
	PDCCH/PCFICH are tra					
	overlapped with the AB		ggressor cell and the	subframe is availa	able in the	
	definition of the reference					
Note 7:	Time-domain measuren	nent resource re	striction pattern for P	Cell measuremen	ts as defined in	
	[7]					
Note 8:	As configured according		nain measurement re	source restriction	pattern for CSI	
	measurements defined					
Note 9:	The number of control C		s not available for AB	BS and is 3 for the	subframe	
	indicated by "0" of ABS					
Note 10:	If the UE reports in an a					
	estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot					
	be applied at the eNB downlink before SF#(n+4).					
Note 11:	Reference measurement channel in Cell 1 RC.2 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.					
	•					
	The number of the CRS			e same.		
Note 13:	SIB-1 will not be transm	itted in Cell2 an	d Cell 3 in this test.			

Table 9.5.4.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3
\hat{E}_s/N_{oc2} for Cell 1 (dB)	4	20	20
$\hat{I}_{or}^{(j)}$ for Cell 1 (dB[mW/15kHz])	-94	-78	-78
Antenna correlation	High for Cell 1, low for Cell 2 and Cell 3	Low for Cell 1, Cell 2 and Cell 3	High for Cell 1, low for Cell 2 and Cell 3
и	N/A	1.05	0.9
72	1.05	N/A	N/A
UE Category	≥2	≥2	≥2

9.5.4.2 TDD

For the parameters specified in Table 9.5.4.2-1, the minimum performance requirement in Table 9.5.4.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_{1}$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

In Table 9.5.4.2-1, Cell 1 is the serving cell, and Cell 2 and Cell 3 are the aggresso cells. The downlink physical channel setup for Cell 1 is according to Annex C.3.2 and for Cell 2 and Cell 3 is according to Annex C.3.3, respectively. The CRS assistance information [7] including Cell 2 and Cell 3 is provided.

Table 9.5.4.2-1: RI Test (TDD)

Parameter			Cell 1	Cell 2	Cell 3
Bandwidth		MHz	10	10	10
PDSCH transmissio	n mode		3	As defined in Note 1	As defined in Note 1
Uplink downlink conf	iguration		1	1	1
Special subframe con			4	4	4
	$\rho_{\scriptscriptstyle A}$	dB	-3	-3	-3
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	-3	-3	-3
anodaton	σ	dB	0	N/A	N/A
Propagation conditi antenna configur			2×2 EPA5 (Note 2)	2x2 EPA5 (Note 2)	2x2 EPA5 (Note 2)
CodeBookSubsetRe bitmap			01 for fixed RI = 1 10 for fixed RI = 2 11 for UE reported RI	As defined in Note 1	As defined in Note 1
	N_{oc1}	dB[mW/15k Hz]	-98 (Note 3)	N/A	N/A
N_{oc} at antenna port	N_{oc2}	dB[mW/15k Hz]	-98 (Note 4)	N/A	N/A
	N_{oc3}	dB[mW/15k Hz]	-93 (Note 5)	N/A	N/A
\hat{E}_s/N_{oc2}		dB	Reference Value in Table 9.5.4.2-2 for each test	12	10
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$		Reference Value in Table 9.5.4.2-2 for each test	-86	-88
Subframe Configu	ration		Non-MBSFN Non-MBS		Non-MBSFN
Time Offset betwee	n Cells	μs	N/A	3	-1
Frequency shift between	een Cells	Hz	N/A	300	-100
Cell Id			0	126	1
ABS pattern (No	te 6)		N/A	0000000001 0000000001	0000000001 0000000001
RLM/RRM Measur Subframe Pattern (l			0000000001 0000000001	N/A	N/A
CSI Subframe Sets	Ccsi,0		0000000001 0000000001	N/A	N/A
(Note 8)	C _{CSI,1}		1100111000 1100111000	N/A	N/A
Number of control symbols	OFDM		3	Note 9	Note 9
Maximum number o transmissions			1	N/A	N/A
Reporting mode			PUCCH 1-0	N/A	N/A
Physical channel for C _{CSI,0} CQI and RI reporting			PUCCH format 2	N/A	N/A
Physical channel for C _{CSI,1} CQI and RI reporting			PUSCH (Note 14)	N/A	N/A
PUCCH Report Type for CQI			4	N/A	N/A
PUCCH Report Type for RI			3	N/A	N/A
Reporting periodicity		ms	N _{pd} = 10	N/A	N/A
ACK/NACK feedback mode			Multiplexing	N/A	N/A
cqi-pmi-Configuratio			8	N/A	N/A
ri-Configuration			5	N/A	N/A
cqi-pmi-Configuration			9	N/A	N/A
ri-Configuration Cyclic prefix			0 Normal	N/A Normal	N/A Normal
Cyclic pielix		<u> </u>	INUITIAI	inullial	Nomal

- Note 1: Downlink physical channel setup in Cell 2 and Cell 3 in accordance with Annex C.3.3 applying OCNG pattern OP.5 TDD as defined in Annex A.5.2.5.
- Note 2: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.
- Note 3: This noise is applied in OFDM symbols #1, #2, #3, #5, #6, #8, #9, #10,#12, #13 of a subframe overlapping with the aggressor ABS.
- Note 4: This noise is applied in OFDM symbols #0, #4, #7, #11 of a subframe overlapping with the aggressor ABS.
- Note 5: This noise is applied in all OFDM symbols of a subframe overlapping with aggressor non-ABS
- Note 6: ABS pattern as defined in [9]. PDSCH other than SIB1/paging and its associated PDCCH/PCFICH are transmitted in the serving cell subframe when the subframe is overlapped with the ABS subframe of aggressor cell and the subframe is available in the definition of the reference channel.
- Note 7: Time-domain measurement resource restriction pattern for PCell measurements as defined in [7]
- Note 8: As configured according to the time-domain measurement resource restriction pattern for CSI measurements defined in [7].
- Note 9: The number of control OFDM symbols is not available for ABS and is 3 for the subframe indicated by "0" of ABS pattern.
- Note 10: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 11: Reference measurement channel in Cell 1 RC.2 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 12: The number of the CRS ports in Cell1, Cell2 and Cell 3 is the same.
- Note 13: SIB-1 will not be transmitted in Cell2 and Cell 3 in this test.
- Note 14: To avoid collisions between RI/CQI reports and HARQ-ACK it is necessary to report them on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI/CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.

Test 2 Test 1 Test 3 E_s/N_{ac2} for Cell 1 (dB) 20 4 20 $\hat{I}_{cr}^{(j)}$ for Cell 1 (dB[mW/15kHz]) -94 -78 -78 High for Cell 1, low for Low for Cell 1, Cell 2 High for Cell 1, low for Antenna correlation and Cell 3 Cell 2 and Cell 3 Cell 2 and Cell 3 N/A 1.05 0.9 1.05 N/A N/A 1/2

≥2

≥2

Table 9.5.4.2-2: Minimum requirement (TDD)

9.5.5 Minimum requirement (with CSI process)

UE Category

Each CSI process is associated with a CSI-RS resource and a CSI-IM resource as shown in Table 9.5.5-1.

≥2

For UE supports one CSI process, CSI process 0 is configured for Test 1 and Test 2, but CSI process 1 is not configured for Test 2. The corresponding γ requirements for Test 1 and Test 2 shall be fulfilled. The requirement on reported RI for CSI process 1 in Test 2 is not applicable.

For UE supports multiple CSI processes, CSI process 0 is configured for Test 1 and CSI processes 0 and 1 are configured for Test 2. The corresponding γ requirements for Test 1 and Test 2 shall be fulfilled, and also the requirement on reported RI for CSI process 1 in Test 2.

Table 9.5.5-1: Configuration of CSI processes

	CSI process 0	CSI process 1
CSI-RS resource	CSI-RS signal 0	CSI-RS signal 1
CSI-IM resource	CSI-IM resource 0	CSI-IM resource 1

9.5.5.1 FDD

The minimum performance requirement in Table 9.5.5.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;
- c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.1-2.

Table 9.5.5.1-1: RI Test (FDD)

			To	st 1	To	st 2	
Para	meter	Unit	TP1	TP2	TP1	TP2	
Bandwidth		MHz		MHz		10 MHz	
Transmission mode			10	10	10	10	
	$ ho_{\scriptscriptstyle A}$	dB		0	()	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	(0	()	
allocation	P_c	dB	0	0	0	0	
	σ	dB		<u> </u>	<u>-</u>))	
SNR	0	dB	0	0	20	20	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-98	-78	-78	
$N_{oc}^{(j)}$		dB[mW/15kHz]		 98	-	98	
	N.	ab[iiiw/iokiiz]	EPA 5 Low	EPA 5 Low	EPA 5 Low	EPA 5 High	
Propagation channe Antenna configuration			2x2	2x2	2x2	2x2	
Beamforming Model				Section B.4.3		Section B.4.3	
Timing offset between	en TPs	us		0	•)	
Frequency offset be		Hz		0)	
Cell-specific referen	ce signals			a ports 0	Antenna	a ports 0	
CSI-RS signal 0			Antenna ports 15,16	N/A	Antenna ports 15,16	N/A	
CSI-RS 0 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/1	N/A	5/1	N/A	
CSI-RS 0 configurat	tion		0	N/A	0	N/A	
CSI-RS signal 1			N/A	Antenna ports 15,16	N/A	Antenna ports 15,16	
CSI-RS 1 periodicity Tcsi-rs / Δcsi-rs	CSI-RS 1 periodicity and subframe offset		N/A	5/1	N/A	5/1	
CSI-RS 1 configurat	tion		N/A	3	N/A	3	
Zero-power CSI-RS 0 configuration I _{CSI-RS} / ZeroPowerCSI-RS bitmap			N/A	1 / 10000010000 00000	N/A	1] / 10000010000 00000	
Zero-power CSI-RS 1 configuration Icsi-RS / ZeroPowerCSI-RS bitmap			1 / 00110000000 00000	N/A	1 / 00110000000 00000	N/A	
CSI-IM 0 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/1	N/A	5/1	N/A	
CSI-IM 0 configurati			2	N/A	2	N/A	
CSI-IM 1 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		N/A	5/1	N/A	5/1	
CSI-IM 1 configurati	on		N/A	6	N/A	6	
RI configuration			Fixed RI=2	N/A	Fixed RI=1	N/A	
3			and follow RI PUSCH (Note		and follow RI PUSCH (Note	PUSCH (Note	
Physical channel for	r CQI/PMI reporting		6)	N/A	6)	6)	
PUCCH Report Typ	e for CQI/PMI		2	N/A	2	2	
Physical channel for	r RI reporting		PUCCH	N/A	PUCCH	PUCCH	
PUCCH Report Typ	•		Format 2	N/A	Format 2	Format 2 3	
. осон кероп тур	CSI-RS		CSI-RS 0	N/A	CSI-RS 0	N/A	
	CSI-IM		CSI-IM 0	N/A	CSI-IM 0	N/A	
	Reporting mode		PUCCH 1-1	N/A	PUCCH 1-1	N/A	
CSI process 0	Reporting periodicity	ms	$N_{pd} = 5$	N/A	$N_{pd} = 5$	N/A	
(Note 7)	CQI delay	ms	8	N/A	10	N/A	
	cqi-pmi- ConfigurationIndex		6	N/A	6	N/A	
	ri-ConfigIndex		1	N/A	1	N/A	
	CSI-RS		N/A	N/A	N/A	CSI-RS 1	
CSI process 1	CSI-IM		N/A	N/A	N/A	CSI-IM 1	
(Note 7, Note 9)	Reporting mode Reporting		N/A	N/A	N/A	PUCCH 1-1	
	periodicity	ms	N/A	N/A	N/A	$N_{\rm pd} = 5$	

CQI delay	ms	N/A	N/A	N/A	10
cqi-pmi- ConfigurationIndex		N/A	N/A	N/A	4
ri-ConfigIndex		N/A	N/A	N/A	1
CSI process for PDSCH scheduling		CSI pro	ocess 0	CSI pro	ocess 0
Cell ID		0	6	0	6
Quasi-co-located CSI-RS		CSI-RS 0	CSI-RS 1	CSI-RS 0	CSI-RS 1
Quasi-co-located CRS		Same Cell ID as Cell 1	Same Cell ID as Cell 2	Same Cell ID as Cell 1	Same Cell ID as Cell 2
PMI for subframe 2, 3, 4, 7, 8 and 9		010000 for fixed RI = 2 010011 for UE reported RI	100000	000011 for fixed RI = 1 010011 for UE reported RI	N/A
PMI for subframe 1 and 6		100000	100000	100000	N/A
Max number of HARQ transmissions		1	N/A	1	N/A

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: 3 symbols allocated to PDCCH
- Note 3: Reference measurement channel RC.13 FDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 2, 3, 4, 7, 8 and 9 from TP1.
- Note 4: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1 and 6 from TP1.
- Note 5: TM10 OCNG as specified in A.5.1.8 is transmitted on subframe 1, 2, 3, 4, 6, 7, 8 and 9 from TP2 for Test 1; TP2 is blanked for Test 2.
- Note 6: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.
- Note 7: If UE supports multiple CSI processes, CSI process 0 is configured as 'RI-reference CSI process' for CSI process 1.
- Note 8: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#1 and #6 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#0 and #5.
- Note 9: If UE supports one CSI process, CSI process 1 is not configured in Test 2.

Table 9.5.5.1-2: Minimum requirement (FDD)

	Test 1	Test 2
21	N/A	1.0
72	1.0	N/A
UE Category	≥2	≥2

9.5.5.2 TDD

The minimum performance requirement in Table 9.5.5.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;
- c) For Test 2, the RI reported for CSI process 1 shall be the same as the most recent RI reported for CSI process 0 if UE is configured with multiple CSI processes.

For the parameters specified in Table 9.5.5.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.5.5.2-2.

Table 9.5.5.2-1: RI Test (TDD)

D			Tes	st 1	Tes	st 2
Para	meter	Unit	TP1	TP2	TP1 TP2	
Bandwidth		MHz		MHz	10 MHz	
Transmission mode	1	dB	10	10	10	10
	$ ho_{\scriptscriptstyle A}$		(0	(
Downlink power	Downlink power $\rho_{\scriptscriptstyle B}$			0	()
allocation	P_c	dB	0	0	0	0
	σ	dB		<u> </u>	(<u> </u>
Uplink downlink con		QD_	2	2	2	2
Special subframe co			4	4	4	4
SNR	9	dB	0	0	20	20
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-98	-98	-78	-78
$N_{oc}^{(j)}$		dB[mW/15kHz]	-6	98	-(98
Propagation channe			EPA 5 Low	EPA 5 Low	EPA 5 Low	EPA 5 High
Antenna configuration			2x2	2x2	2x2	2x2
Beamforming Mode			· · · · · · · · · · · · · · · · · · ·	Section B.4.3		Section B.4.3
Timing offset between Frequency offset be		us Hz		<u>0</u> 0	()
Cell-specific referen		ПΖ		a ports 0	Antenna	
	ce signais		Antenna ports		Antenna ports	
CSI-RS signal 0	and subframe offset		15,16	N/A	15,16	N/A
T _{CSI-RS} / Δ _{CSI-RS}			5/3	N/A	5/3	N/A
CSI-RS 0 configurat	ion		0	N/A	0	N/A
CSI-RS signal 1			N/A	Antenna ports 15,16	N/A	Antenna ports 15,16
CSI-RS 1 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		N/A	5/3	N/A	5/3
	CSI-RS 1 configuration		N/A	3	N/A	3
	Zero-power CSI-RS 0 configuration I _{CSI-RS} / ZeroPowerCSI-RS bitmap		N/A	3 / 10000010000 00000	N/A	3 / 10000010000 00000
Zero-power CSI-RS Icsi-RS / ZeroPowerC			3 / 00110000000 00000	N/A	3 / 00110000000 00000	N/A
CSI-IM 0 periodicity $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$	and subframe offset		5/3	N/A	5/3	N/A
CSI-IM 0 configurati	on		2	N/A	2	N/A
CSI-IM 1 periodicity	and subframe offset		N/A	5/3	N/A	5/3
T _{CSI-RS} / Δ _{CSI-RS}						
CSI-IM 1 configurati	on		N/A Fixed RI=2	6	N/A Fixed RI=1	6
RI configuration			and follow RI	N/A	and follow RI	N/A
	CSI-RS		CSI-RS 0	N/A	CSI-RS 0	N/A
CSI process 0	CSI-IM		CSI-IM 0	N/A	CSI-IM 0	N/A
(Note 6, 7)	Reporting mode Reporting Interval	ms	PUSCH 3-1 5	N/A N/A	PUSCH 3-1 5	N/A N/A
	CQI delay	ms	11	N/A	11	N/A
	CSI-RS	1113	N/A	N/A	N/A	CSI-RS 1
001 1	CSI-IM		N/A	N/A	N/A	CSI-IM 1
CSI process 1	Reporting mode		N/A	N/A	N/A	PUSCH 3-1
(Note 6, 7, 8) Reporting Interval		ms	N/A	N/A	N/A	5
CQI delay		ms	N/A	N/A	N/A	11
CSI process for PDSCH scheduling				ocess 0		ocess 0
Cell ID Quasi-co-located CS	SI DC		0	6 CSI-RS 1	0	6 CSI-RS 1
			CSI-RS 0 Same Cell ID	Same Cell ID	CSI-RS 0 Same Cell ID	Same Cell ID
Quasi-co-located CF	_		as Cell 1	as Cell 2	as Cell 1	as Cell 2
PMI for subframe 4	and 9		010000 for	100000	000011 for	N/A

	fixed RI = 2		fixed RI = 1	
	010011 for UE		010011 for UE	
	reported RI		reported RI	
PMI for subframe 3 and 8	100000	100000	100000	N/A
Max number of HARQ transmissions	1	N/A	1	N/A
ACK/NACK feedback mode	Multiplexing	N/A	Multiplexing	N/A

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: 3 symbols allocated to PDCCH
- Note 3: Reference measurement channel RC.13 TDD according to Table A.4-1. PDSCH transmission is scheduled on subframe 4 and 9 from TP1.
- Note 4: TM10 OCNG as specified in A.5.2.8 is transmitted on subframe 3 and 8 from TP1.
- Note 5: TM10 OCNG as specified in A.5.2.8 is transmitted on subframe 3, 4, 8 and 9 from TP2 for Test 1; TP2 is blanked for Test
- Note 6: Reported wideband CQI and PMI are used and sub-band CQI is discarded.
- Note 7: If UE supports multiple CSI processes, CSI process 0 is configured as 'RI-reference CSI process' for CSI process 1.
- Note 8: If UE supports one CSI process, CSI process 1 is not configured in Test 2.
- Note 9: PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#3and #8 to allow aperiodic CQI/PMI/RI to be transmitted in uplink SF#7 and #2.

Table 9.5.5.2-2: Minimum requirement (TDD)

	Test 1	Test 2
2/1	N/A	1.0
72	1.0	N/A
UE Category	≥2	≥2

9.6 Additional requirements for carrier aggregation

This clause includes requirements for the reporting of channel state information (CSI) with the UE configured for carrier aggregation. The purpose is to verify that the channel state for each cell is correctly reported with multiple cells configured for periodic reporting.

9.6.1 Periodic reporting on multiple cells (Cell-Specific Reference Symbols)

9.6.1.1 FDD

The following requirements apply to UE Category \geq 3. For CA with 2 DL CC, for the parameters specified in Table 9.6.1.1-1 and Table 9.6.1.1-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband CQI_{Pcell} – wideband $CQI_{Scell} \ge 2$

Table 9.6.1.1-1: Parameters for PUCCH 1-0 static test on multiple cells (FDD, 2 DL CA)

Parameter		Unit	Pcell	Scell
PDSCH transmission	PDSCH transmission mode			1
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0
Propagation condition and antenna configuration			AWGN (1 x 2)	
SNR		dB	10	4
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-94
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
Physical channel f reporting	Physical channel for CQI reporting		PUCCH	l Format 2
PUCCH Report Type				4
Reporting periodicity		ms	$N_{\rm pd} = 10$	
cqi-pmi-ConfigurationIndex			11	16 (shift of 5 ms relative to Pcell)
Note 1: 3 symbols	are allocat	ed to DDCCH No D	DSCH for user data is ech	eduled for the LIE with one

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: Void

Table 9.6.1.1-2: PUCCH 1-0 static test (FDD, 2 DL CA)

Test nu	mber	er Bandwidth combination		
1	1 10MHz for both cells			
2		20MHz for both cells		
3		5MHz for both cells		
4 5MHz for PCell and 10MHz for SCell		5MHz for PCell and 10MHz for SCell		
5 5MHz for PCell and 15MHz for SCell		5MHz for PCell and 15MHz for SCell		
Note 1: Note 2:	bandwidth combination sets is defined in 9.1.1.2. The test coverage fo different number of component carriers is defined in 9.1.1.3.			
	mappin	•		

The following requirements for 3DL CA apply to UE Category \geq 5. For CA with 3 DL CC, for the parameters specified in Table 9.6.1.1-3 and Table 9.6.1.1-4, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell2 reported shall be such that

wideband CQI_{PCell} – wideband $CQI_{SCell1} \ge 2$

wideband COI_{SCell1} - wideband COI_{SCell2} > 2

for more than 90% of the time.

The following requirements for 4DL CA apply to UE Category ≥8. For CA with 4 DL CC, for the parameters specified in Table 9.6.1.1-3 and Table 9.6.1.1-5, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell 3 reported shall be such that

 $wideband \ CQI_{PCell} - wideband \ CQI_{SCell1} \geq 2$

wideband CQI_{SCell1} – wideband $CQI_{SCell2} \ge 2$

wideband CQI_{SCell1} – wideband $CQI_{SCell3} \ge 2$

Table 9.6.1.1-3: Parameters for PUCCH 1-0 static test on multiple cells (FDD, 3 and 4 DL CA)

Parameter		Unit	Pcell	Scell1	Scell2, 3		
PDSCH transmission	PDSCH transmission mode			1			
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0				
allocation	$ ho_{\scriptscriptstyle B}$	dB			0		
Propagation condit antenna configur			AWGN (1 x 2)				
SNR		dB	12	6	0		
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98		
$N_{oc}^{(j)}$	$N_{oc}^{(j)}$		-98	-98	-98		
Physical channel f reporting	Physical channel for CQI reporting		PUCCH Format 2				
PUCCH Report	Туре				4		
Reporting period	dicity	ms		Λ	$I_{pd} = 20$		
cqi-pmi-Configurati	cqi-pmi-ConfigurationIndex 21 26 (Shift of 5 ms relative to Pcell) relative to Pcel		31 for Scell2 (shift of 10 ms relative to Pcell), 36 for Scell3 (shift of 15ms relative to Pcell)				
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.				duled for the UE with one sided			
Note 2: Void							

Table 9.6.1.1-4: PUCCH 1-0 static test (FDD, 3 DL CA)

Test r	st number Bandwidth combination (MHz)			
	1	3x20		
	2	20+20+15		
	3	20+20+10		
	4	20+15+15		
	5	20+15+10		
	6	20+10+10		
	7	15+15+10		
8		20+10+5		
	9	20+15+5		
•	10	10+10+5		
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. The test coverage for different number of component carriers is defined in 9.1.1.3.			
Note 2:	If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping.			

Table 9.6.1.1-5: PUCCH 1-0 static test (FDD, 4 DL CA)

Test number	Bandwidth combination (MHz)	
1	4x20	
2	20+20+20+10	
3	20+20+10+10	
4	20+20+10+5	
5	20+10+10+5	
configurat defined in number of	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. The test coverage for different number of component carriers is defined in 9.1.1.3.	
choose or as PCell. I shall be co	If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping.	

The following requirements for 5DL CA apply to UE Category 8 and \geq 11. For CA with 5 DL CC, for the parameters specified in Table 9.6.1.1-6 and Table 9.6.1.1-7, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell 3, and SCell 1 and SCell 4 reported shall be such that

 $\label{eq:continuous_continuous$

Table 9.6.1.1-6: Parameters for PUCCH 1-0 static test on multiple cells (FDD, 5 DL CA)

Parameter		Unit	Pcell	Scell1	Scell2, 3, 4	
PDSCH transmission mode				1		
Downlink power	Downlink power $ ho_{\scriptscriptstyle A}$			0		
allocation	$ ho_{\scriptscriptstyle B}$	dB			0	
Propagation condition antenna configuration				AWGN (1 x 2)		
SNR		dB	12	6	0	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	
Physical channel for reporting	Physical channel for CQI reporting		PUCCH Format 2			
PUCCH Report Type	١		4			
Reporting periodicity		ms		٨	$V_{pd} = 40$	
cqi-pmi-ConfigurationIndex			41	46 (shift of 5 ms relative to Pcell)	51 for Scell 2 (shift of 10 ms relative to Pcell), 56 for Scell 3 (shift of 15ms relative to Pcell), 61 for Scell4 (shift of 20ms relative to Pcell)	
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1. Note 2: Void						

Table 9.6.1.1-7: PUCCH 1-0 static test (FDD, 5 DL CA)

Test number	Bandwidth combination (MHz)
1	5x20
configura defined ir	cability of requirements for different CA tions and bandwidth combination sets is 9.1.1.2. The test coverage for different f component carriers is defined in 9.1.1.3.
choose o as PCell. shall be o	an one cell can be configured as PCell, ne of the cells with the smallest bandwidth Mapping of PCell and Scells to the CCs onstant for all the iterations during the test cution of the test shall use the same

9.6.1.2 TDD

The following requirements apply to UE Category \geq 3. For CA with 2 DL CC, for the parameters specified in Table 9.6.1.2-1 and Table 9.6.1.2-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of Pcell and Scell reported shall be such that

wideband CQI_{Pcell} – wideband $CQI_{Scell} \ge 2$

for more than 90% of the time.

Table 9.6.1.2-1: PUCCH 1-0 static test on multiple cells (TDD, 2 DL CA)

Parameter	1	Unit	Pcell	Scell
PDSCH transmission mode				1
Uplink downlink con	figuration		2	
Special subfra configuration			4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0
allocation	$ ho_{\scriptscriptstyle B}$	dB		0
Propagation condition and antenna configuration			AWGN	l (1 x 2)
SNR		dB	10	4
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-94
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
Physical channel for CQI reporting			PUCCH	Format 2
PUCCH Report Type			4	
Reporting periodicity		ms	$N_{\rm pd} = 10$	
cqi-pmi-ConfigurationIndex			8 13 (shift of 5 ms relat to Pcell)	
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one				

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 2: Void

Table 9.6.1.2-2: PUCCH 1-0 static test (TDD, 2 DL CA)

Test number Bandwidth combination		Bandwidth combination	
1 20MHz for both cells		20MHz for both cells	
2 15MHz for PCell and 20MHz for SCell		15MHz for PCell and 20MHz for SCell	
Note 1:	and bar	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. The test coverage for different number of component carriers is defined in 9.1.1.3.	
Note 2:	the itera	Mapping of PCell and Scell to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping.	

The following requirements for 3DL CA apply to UE Category \geq 5. For CA with 3 DL CC, for the parameters specified in Table 9.6.1.2-3 and Table 9.6.1.2-4, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell2 reported shall be such that

$$wideband \; CQI_{PCell} - wideband \; CQI_{SCell1} \geq 2$$

 $wideband \ CQI_{SCell1} - wideband \ CQI_{SCell2} \geq 2$

for more than 90% of the time.

The following requirements for 4DL CA apply to UE Category ≥8. For CA with 4 DL CC, for the parameters specified in Table 9.6.1.2-3 and Table 9.6.1.2-5, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell 1 and SCell2, and SCell 3 reported shall be such that

wideband CQI_{PCell} – wideband $CQI_{SCell1} \ge 2$

wideband CQI_{SCell1} – wideband $CQI_{SCell2} \ge 2$

 $wideband \ CQI_{SCell1} - wideband \ CQI_{SCell3} \geq 2$

Table 9.6.1.2-3: PUCCH 1-0 static test on multiple cells (TDD, 3 and 4 DL CA)

Parameter		Unit	Pcell	Scell1	Scell2, 3
PDSCH transmission mode				1	
Uplink downlink conf	iguration		2		
Special subfra configuration				4	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0	
Propagation condit antenna configur				AWGN (1 x 2)	
SNR		dB	12	6	0
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98
Physical channel for CQI reporting				PUCCH Format 2	
PUCCH Report	Туре			4	
Reporting periodicity		ms	N _{pd} = 20		
cqi-pmi-ConfigurationIndex			18	23 (shift of 5 ms relative to Pcell)	28 (shift of 10 ms relative to Pcell) , 33 for Scell3 (shift of 15ms relative to Pcell)

Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 2: Void

Table 9.6.1.2-4: PUCCH 1-0 static test (TDD, 3 DL CA)

Test number		Bandwidth combination (MHz)
	1	3x20
	2	20+20+15
Note 1:	configuration defined in 9	ability of requirements for different CA ons and bandwidth combination sets is 0.1.1.2. The test coverage for different component carriers is defined in 9.1.1.3.
Note 2:	If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping.	

Table 9.6.1.2-5: PUCCH 1-0 static test (TDD, 4 DL CA)

Test number		Bandwidth combination (MHz)
	1	4x20
	2	20+20+20+15
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2. The test coverage for different number of component carriers is defined in 9.1.1.	
Note 2:	If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test Each execution of the test shall use the same mapping.	

9.6.1.3 TDD-FDD CA with FDD PCell

The following requirements apply to UE Category ≥5. For TDD-FDD CA with FDD PCell with 2 DL CC, for the parameters specified in Table 9.6.1.3-1 and Table 9.6.1.3-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell reported shall be such that

wideband CQI_{PCell} – wideband $CQI_{SCell} \ge 2$

for more than 90% of the time.

Table 9.6.1.3-1: Parameters for PUCCH 1-0 static test on multiple cells (TDD-FDD CA with FDD PCell, 2 DL CA)

Parameter		Unit	PCell	SCell
PDSCH transmission mode				1
Uplink downlink con	figuration		N/A	2
Special subfra configuration			N/A	4
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0
allocation	$ ho_{\scriptscriptstyle B}$	dB		0
Propagation condit antenna configu			AWGN (1 x 2)	
SNR		dB	10	4
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$		-88	-94
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
Physical channel for CQI reporting			PUCC	CH Format 2
PUCCH Report	Туре			4
Reporting period	Reporting periodicity		$N_{pd} = 10$	
cqi-pmi-ConfigurationIndex			9	14 (shift of 5 ms relative to Pcell)
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.				
Note 2: Void	Note 2: Void			

Table 9.6.1.3-2: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 2 DL CA)

Test number Bandwidth combination			
1 20MHz for FDD cell and 20MHz for TDD cell		20MHz for FDD cell and 20MHz for TDD cell	
2 10MHz for FDD cell and 20MHz for TDD cell		10MHz for FDD cell and 20MHz for TDD cell	
3	3 15MHz for FDD cell and 20MHz for TDD cell		
Note 1:	The applicability of requirements for different CA configurations and		
	bandwidth combination sets is defined in 9.1.1.2A. The test coverage		
	for different number of component carriers is defined in 9.1.1.3.		

The following requirements for 3DL CA apply to UE Category \geq 5. For TDD-FDD CA with FDD PCell with 3 DL CC, for the parameters specified in Table 9.6.1.3-3 and Table 9.6.1.3-4, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2 reported shall be such that

wideband $CQI_{PCell}-wideband \ CQI_{SCell1} \geq 2$

 $wideband \ CQI_{SCell1} - wideband \ CQI_{SCell2} \geq 2$

for more than 90% of the time.

Note 3:

Void

The following requirements for 4DL CA apply to UE Cateogry ≥8. For TDD-FDD CA with FDD PCell with 4 DL CC, for the parameters specified in Table 9.6.1.3-3 and Table 9.6.1.3-5, and using the downlink physical channels specified

in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, and SCell1 and SCell3 reported shall be such that

 $wideband \; CQI_{PCell} - wideband \; CQI_{SCell1} \geq 2$

 $wideband \ CQI_{SCell1} - wideband \ CQI_{SCell2} \geq 2$

 $wideband \ CQI_{SCell1} - wideband \ CQI_{SCell3} \geq 2$

Table 9.6.1.3-3: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with FDD PCell, 3 and 4 DL CA)

Parameter		Unit	PCell	SCell1	SCell2, SCell3
PDSCH transmission mode				11	
Uplink downlink conf	guration		N/A	2 for TDD Cell N/A for FDD Cell	
Special subfra configuration			N/A	N/A 4 for TDD Cell N/A for is FDD Cell	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0	
allocation	$ ho_{\scriptscriptstyle B}$	dB		0	
Propagation condit antenna configur				AWGN (1	x 2)
SNR		dB	12	6	0
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98
Physical channel for CQI reporting			PUCCH Format 2		
PUCCH Report Type			4		
Reporting period	dicity	ms		$N_{\rm pd} = 2$	20
cqi-pmi-ConfigurationIndex			19	24 (shift of 5 ms relative to Pcell)	29 for SCell 2 (shift of 10 ms relative to Pcell) , 34 for SCell 3 (shift of 15ms relative to PCell)
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1. Note 2: Void Note 3: Void					

Table 9.6.1.3-4: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 3 DL CA)

Test number		Bandwidth combination (MHz)	
1		20MHz for FDD cell and 2x20MHz for TDD cell	
	2	15MHz for FDD cell and 2x20MHz for TDD cell	
	3	10MHz for FDD cell and 2x20MHz for TDD cell	
	4	2x20MHz for FDD cell and 20MHz for TDD cell	
	5	20+15MHz for FDD cell and 20MHz for TDD cell	
6		20+10MHz for FDD cell and 20MHz for TDD cell	
Note 1:	Note 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3.		
Note 2: If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shal use the same mapping.			

Table 9.6.1.3-5: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 4 DL CA)

Test number		Bandwidth combination (MHz)		
1		20MHz for FDD cell and 3x20MHz for TDD cell		
	2	2x20MHz for FDD cell and 2x20MHz for TDD cell		
	3	20+15MHz for FDD cell and 2x20MHz for TDD cell		
	4	2x15MHz for FDD cell and 2x20MHz for TDD cell		
	5	2x20+15MHz for FDD cell and 20MHz for TDD cell		
6		2x15+20MHz for FDD cell and 20MHz for TDD cell		
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3.			
Note 2:	Note 2: If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping.			

The following requirements for 5DL CA apply to UE Category 8 and ≥11. For TDD-FDD CA with FDD PCell with 5 DL CC, for the parameters specified in Table 9.6.1.3-3 and Table 9.6.1.3-6, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, SCell1 and SCell3, and SCell 1 and SCell 4 reported shall be such that

$$\label{eq:continuous_problem} \begin{split} \text{wideband } CQI_{PCell} - \text{wideband } CQI_{SCell1} \geq 2 \\ \\ \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell2} \geq 2 \\ \\ \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell3} \geq 2 \\ \\ \text{wideband } CQI_{SCell1} - \text{wideband } CQI_{SCell4} \geq 2 \end{split}$$

Table 9.6.1.3-6: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with FDD PCell, 5 DL CA)

Danamatan		1124	DO-II	00-114	00-110 00-110 00-114
Parameter		Unit	PCell	SCell1	SCell2, SCell3, SCell4
PDSCH transmission mode			1 2 for TDD Coll		
Uplink downlink config	uration		N/A 2 for TDD Cell N/A for FDD Cell		
Special subframe			4 for TDD Cell		
configuration			N/A N/A for FDD Cell		
Downlink power	$\rho_{\scriptscriptstyle A}$	dB	0		
allocation	$\rho_{\scriptscriptstyle B}$	dB	0		
Propagation condition and antenna configuration			AWGN (1 x 2)		
SNR		dB	12	6	0
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98
Physical channel for CQI reporting			PUCCH Format 2		
PUCCH Report Type		4			
Reporting periodicity	ms	$N_{\rm pd} = 40$			
cqi-pmi-ConfigurationIndex			39	44 (shift of 5 ms relative to Pcell)	49 for SCell 2 (shift of 10 ms relative to Pcell), 54 for SCell 3 (shift of 15 ms relative to Pcell), 59 for SCell 4 (shift of 20 ms relative to Pcell)
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1. Note 2: Void Note 3: Void					

Table 9.6.1.3-7: PUCCH 1-0 static test (TDD-FDD CA with FDD PCell, 5 DL CA)

Test number		Bandwidth combination (MHz)		
	1	15MHz+2×20MHz for FDD cell and 2x20MHz for TDD cell		
	2	2×15MHz+20MHz for FDD cell and 2x20MHz for TDD cell		
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3.			
Note 2:	If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping.			

9.6.1.4 TDD-FDD CA with TDD PCell

The following requirements apply to UE Category ≥5. For TDD-FDD CA with TDD PCell with 2 DL CC, for the parameters specified in Table 9.6.1.4-1 and Table 9.6.1.4-2, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell reported shall be such that

 $wideband \ CQI_{PCell} - wideband \ CQI_{SCell} \geq 2$

for more than 90% of the time.

Table 9.6.1.4-1: Parameters for PUCCH 1-0 static test on multiple cells (TDD-FDD CA with TDD PCell, 2 DL CA)

Parameter		Unit	PCell	SCell
PDSCH transmission mode				1
Uplink downlink configuration			2	N/A
Special subfra configuration			4	N/A
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0	
allocation	$ ho_{\scriptscriptstyle B}$	dB	0	
Propagation condition and antenna configuration			AWGN (1 x 2)	
SNR	•		10	4
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-88	-94
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
Physical channel for CQI reporting			PUCCH Format 2	
PUCCH Report Type			4	
Reporting periodicity		ms	$N_{pd} = 10$	
cqi-pmi-ConfigurationIndex			8	13 (shift of 5 ms relative to Pcell)
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1.				

Note 2: Void Note 3: Void

Table 9.6.1.4-2: PUCCH 1-0 static test (TDD-FDD CA with TDD PCell, 2 DL CA)

	Test number		Bandwidth combination
	1		20MHz for TDD cell and 20MHz for FDD cell
	2		20MHz for TDD cell and 10MHz for FDD cell
	3		20MHz for TDD cell and 15MHz for FDD cell
Ν			olicability of requirements for different CA configurations and
bandwidth combination sets is defined in 9			of the combination sets is defined in 9.1.1.2A. The test coverage
for different number of component carriers is defined in 9.1.1.3			

The following requirements for 3DL CA apply to UE Category ≥5. For TDD-FDD CA with TDD PCell with 3 DL CC, for the parameters specified in Table 9.6.1.4-3 and Table 9.6.1.4-4, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2 reported shall be such that

> wideband CQI_{PCell} – wideband $CQI_{SCell1} \ge 2$ wideband CQI_{SCell1} – wideband $CQI_{SCell2} \ge 2$

for more than 90% of the time.

The following requirements for 4DL CA apply to UE Cateogry ≥8. For TDD-FDD CA with TDD PCell with 4 DL CC, for the parameters specified in Table 9.6.1.4-3 and Table 9.6.1.4-5, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband COI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, and SCell3 reported shall be such that

> wideband CQI_{PCell} – wideband $CQI_{SCell1} \ge 2$ wideband CQI_{SCell1} – wideband $CQI_{SCell2} \ge 2$ wideband CQI_{SCell1} – wideband $CQI_{SCell3} \ge 2$

for more than 90% of the time.

Table 9.6.1.4-3: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with TDD PCell, 3 and 4 DL CA)

Parameter		Unit	PCell	SCell1	SCell2, SCell3
PDSCH transmission mode				1	
Uplink downlink configuration			2 for TDD Cell N/A for FDD Cell		
Special subfra configuration			4 4 for TDD Cell N/A for FDD Cell		
Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0		
allocation	$ ho_{\scriptscriptstyle B}$	dB	0		
Propagation condit antenna configur				AWGN (1 x 2)	
SNR		dB	12	6	0
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92	-98
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98
Physical channel for CQI reporting			PUCCH Format 2		nat 2
PUCCH Report Type				4	
Reporting periodicity		ms		<i>N</i> _{pd} = 20	
cqi-pmi-ConfigurationIndex			18	23 (shift of 5 ms relative to Pcell)	28 for SCell 2 (shift of 10 ms relative to Pcell), 33 for SCell 3 (shift of 15ms relative to PCell)
				r user data is scheduled fo as described in Annex A.5	r the UE with one sided

Note 3: Void

Table 9.6.1.4-4: PUCCH 1-0 static test (TDD-FDD CA with TDD PCell, 3 DL CA)

Test number		Bandwidth combination (MHz)		
	1	2x20MHz for TDD cell and 20MHz for FDD cell		
	2	2x20MHz for TDD cell and 15MHz for FDD cell		
	3	2x20MHz for TDD cell and 10MHz for FDD cell		
	4	2x20MHz for FDD cell and 20MHz for TDD cell		
	5	20+15MHz for FDD cell and 20MHz for TDD cell		
	6	20+10MHz for FDD cell and 20MHz for TDD cell		
Note 1:	The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3.			
Note 2:	Note 2: If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping.			

Table 9.6.1.4-5: PUCCH 1-0 static test (TDD-FDD CA with TDD PCell, 4 DL CA)

Test number		Bandwidth combination (MHz)	
1		3x20MHz for TDD cell and 20MHz for FDD cell	
	2	2x20MHz for FDD cell and 2x20MHz for TDD cell	
	3	20+15MHz for FDD cell and 2x20MHz for TDD cell	
	4	2x15MHz for FDD cell and 2x20MHz for TDD cell	
	5	2x20+15MHz for FDD cell and 20MHz for TDD cell	
6		2x15+20MHz for FDD cell and 20MHz for TDD cell	
Note 1:	e 1: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 9.1.1.2A. The test coverage for different number of component carriers is defined in 9.1.1.3.		
Note 2:	2: If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use the same mapping.		

The following requirements for 5DL CA apply to UE Category 8 and \geq 11. For TDD-FDD CA with TDD PCell with 5 DL CC, for the parameters specified in Table 9.6.1.4-3 and Table 9.6.1.4-6, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, SCell1 and SCell3 and SCell 1 and SCell 4 reported shall be such that

 $\label{eq:continuous_continuous$

Table 9.6.1.4-6: PUCCH 1-0 static test on multiple cells (TDD-FDD CA with TDD PCell, 5 DL CA)

Parameter		Unit	PCell	SCell1	SCell2, SCell3, SCell4	
PDSCH transmission	n mode			1		
Uplink downlink conf	iguration		2	2 if Scell1 is TDD Cell N/A if Scell1 is FDD Cell		
Special subframe configuration			4		ell1 is TDD Cell cell1 is FDD Cell	
Downlink power	$ ho_{\scriptscriptstyle A}$	dB		0		
allocation	$ ho_{\scriptscriptstyle B}$	dB		0		
Propagation condition antenna configuration				AWGN (1 x 2)	
SNR		dB	12	6	0	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-86	-92 -98		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98 -98		
Physical channel for reporting	CQI			PUCCH F	ormat 2	
PUCCH Report Type)			4		
Reporting periodicity	,	ms		$N_{pd} =$	40	
cqi-pmi-Configuratio	nIndex		38	48 for SCell 2 (shift of 10 ms relative to Pcell) 48 for SCell 2 (shift of 10 ms relative to Pcell), 53 for SCell 3 (shift of 15 ms relative to Pcell), 58 for SCell 4 (shift of 20 ms relative to Pcell)		
Note 1: 3 symbols are allocated to PDCCH. No PDSCH for user data is scheduled for the UE with one sided dynamic OCNG Pattern OP.1 FDD and OP.1 TDD as described in Annex A.5.1.1 and A.5.2.1. Note 2: Void Note 3: Void						

Table 9.6.1.4-7: PUCCH 1-0 static test (TDD-FDD CA with TDD PCell, 5 DL CA)

	Test number	Bandwidth combination (MHz)
1		15MHz+2×20MHz for FDD cell and 2x20MHz for TDD cell
2		2×15MHz+20MHz for FDD cell and 2x20MHz for TDD cell
Note 1:		irements for different CA configurations and bandwidth
	combination sets is defi component carriers is d	ned in 9.1.1.2A. The test coverage for different number of efined in 9.1.1.3.
Note 2: If more than one cell can be configured as PCell, choose one of the cells with the smallest bandwidth as PCell. Mapping of PCell and Scells to the CCs shall be constant for all the iterations during the test. Each execution of the test shall use t same mapping.		PCell. Mapping of PCell and Scells to the CCs shall be

9.7 CSI reporting (Single receiver antenna)

The number of receiver antennas N_{RX} assumed for the minimum performance requirement in this clause is 1.

9.7.1 CQI reporting definition under AWGN conditions

9.7.1.1 FDD and half-duplex FDD

The following requirements apply to UE DL Category 0. For the parameters specified in Table 9.7.1.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.16 FDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.7.1.1-1: PUCCH 1-0 static test (FDD and half-duplex FDD)

Parameter		Unit	Tes	Test 1 Test 2		st 2
Bandwidth		MHz	10			
PDSCH transmission	PDSCH transmission mode		1			
$ ho_{\scriptscriptstyle A}$		dB	0			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0			
	σ	dB	0			
Propagation condition and antenna configuration			AWGN (1 x 1)			
SNR (Note 2)		dB	0	1	6	7
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$		-98	-97	-92	-91
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98	
Max number of H transmission			1			
Physical channel for CQI reporting			PUCCH Format 2			
PUCCH Report Type			4			
Reporting periodicity		ms	$N_{pd} = 40$			
cqi-pmi-Configurati	onIndex		41			

Note 1: Reference measurement channel RC.16 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/OP.2 FDD as described in Annex A.5.1.1/A.5.1.2.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

9.7.1.2 TDD

The following requirements apply to UE DL Category 0. For the parameters specified in Table 9.7.1.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.16 TDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Multiplexing

Parameter Unit Test 1 Test 2 Bandwidth MHz 10 PDSCH transmission mode 1 Uplink downlink configuration 2 Special subframe configuration 4 dB 0 $\rho_{\scriptscriptstyle A}$ Downlink power dB 0 $\rho_{\scriptscriptstyle B}$ allocation dB 0 σ Propagation condition and AWGN (1 x 1) antenna configuration SNR (Note 2) dB 0 $\hat{\boldsymbol{I}}^{(j)}$ -98 -97 -92 -91 dB[mW/15kHz] $N^{(j)}$ -98 dB[mW/15kHz] -98 Max number of HARQ 1 transmissions Physical channel for CQI PUSCH (Note 3) reporting PUCCH Report Type 4 $N_{pd} = 5$ Reporting periodicity ms cgi-pmi-ConfigurationIndex 3

Table 9.7.1.2-1: PUCCH 1-0 static test (TDD)

- Note 1: Reference measurement channel RC.16 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/OP.2 TDD as described in Annex A.5.2.1/A.5.2.2.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

9.7.2 CQI reporting under fading conditions

9.7.2.1 FDD and half-duplex FDD

ACK/NACK feedback mode

For the parameters specified in Table 9.7.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.7.2.1-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band;
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set S shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD and in each available downlink transmission instance for half-duplex FDD.

Table 9.7.2.1-1 Sub-band test for single antenna transmission (FDD and half-duplex FDD)

Parai	Parameter		Tes	Test 1 Test		st 2
Bandwidth		MHz	10 MHz			
Transmiss	Transmission mode			1 (port 0)		
Downlink	$ ho_{\scriptscriptstyle A}$	dB		0		
power	power $\rho_{\scriptscriptstyle R}$		0			
allocation	σ	dB	0			
SNR (Note 3)	dB	8	9	13	14
	(j) or	dB[mW/15kHz]	-90 -89 -85 -8		-84	
N	$N_{oc}^{(j)}$		-98 -98		98	
Propagation	Propagation channel		Clause B.2.4 with $\tau_d = 0.45 \mu \text{s}$ $a = 1, \ f_D = 5 \text{Hz}$			
Antonna co	onfiguration		U D			
		m.a		1 x 1		
	g interval	ms		8		
CQI delay		ms		8		
Reporting mode		DD		PUSCH 3-0		
Sub-band size		RB		6 (ful	l size)	
	er of HARQ issions				1	

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.16 FDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.7.2.1-2 Minimum requirement (FDD and half-duplex FDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
UE DL Category	0	0

9.7.2.2 TDD

For the parameters specified in Table 9.7.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.7.2.2-2 and by the following

- a) a sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % for each sub-band:
- b) the ratio of the throughput obtained when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected sub-band in set *S* shall be $\geq \gamma$;
- c) when transmitting on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level the corresponding TBS, the average BLER for the indicated transport formats shall be greater or equal to 0.05.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance for TDD.

Table 9.7.2.2-1 Sub-band test for single antenna transmission (TDD)

Parai	neter	Unit	Te	Test 1 Test 2		t 2
Band	width	MHz		10	MHz	
Transmiss	sion mode			1 (port 0)		
Downlink	Downlink $ ho_{\scriptscriptstyle A}$			0		
power	$ ho_{\scriptscriptstyle B}$	dB		(0	
allocation	σ	dB			0	
Uplink o	lownlink uration				2	
Special s	subframe uration				4	
SNR (Note 3)	dB	8	9	13	14
\hat{I}_{a}^{0}	(j) or	dB[mW/15kHz]	-90 -89 -85		-85	-84
N	$N_{oc}^{(j)}$		-98 -98		8	
				Clause B.2.4 with		
Propagatio	on channel		1 7	$ au_d = 0.45 \mu \text{s}, a = 1,$		1,
opaga				$f_D = 5 \mathrm{Hz}$		
Antenna co	onfiguration		1 x 1			
	g interval	ms		5		
	delay	ms	10 or 11			
Reportir	ng mode			PUSCH 3-0		
Sub-ba		RB		6 (full size)		
Max number of HARQ					1	
transm					'	
ACK/NACK feedback mode Multiplexing						
	Note 1: If the UE reports in an available uplink reporting instance at subframe					
		l estimation at a do				
	SF#(n-4), this reported subband or wideband CQI cannot be applied at					

the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.16 TDD according to Table A.4-1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.

Note 3: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Table 9.7.2.2-2 Minimum requirement (TDD)

	Test 1	Test 2
α[%]	2	2
β[%]	55	55
γ	1.1	1.1
UE DL Category	0	0

CSI reporting (UE supporting coverage enhancement) 9.8

The requirements in this sub-clause are defined based on the simulation results with UE DL Category M1 unless otherwise stated.

The requirements of UE DL Category M1 in this sub-clause are applicable for UE DL Category 0.

9.8.1 CQI reporting definition under AWGN conditions

9.8.1.1 FDD and half-duplex FDD

The following requirements apply to UE supporting coverage enhancement. For the parameters specified in Table 9.8.1.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.23 FDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.8.1.1-1: PUCCH 1-0 static test (FDD and half-duplex FDD)

Parameter		Unit	Test 1			
Bandwidth		MHz	1	0		
PDSCH transmission	on mode		•	1		
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	σ	dB	()		
	δ	dB	()		
Propagation condit antenna configur			AWGN	(1 x 1)		
SNR (Note 2		dB	5	6		
$\hat{I}_{or}^{(j)}$,	dB[mW/15kHz]	-93	-92		
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98		
Max number of F transmission				1		
Physical channel for CQI			PUSCH (Note 4)			
	reporting PUCCH Report Type		4			
Reporting period		ms		0		
CQI delay	aloity	ms		0		
cqi-pmi-Configurati	onIndex	0		2		
	Frequency hopping		Disa	bled		
Frequency hopping (interval-FDI			N	/A		
Starting OFDM sylvartSymbolE	ymbol		;	3		
PDSCH repetition			1			
MPDCCH repetition			1			
MPDCCH	Beamforming Precoder for MPDCCH		No precoding			
Precoder update gr for MPDCCI	Precoder update granularity		N/A			
BL/CE DL subframe comfiguration (fdd- DownlinkOrTddSubframeBitm apBR)			111111111			
Note 1: Reference						

- Note 1: Reference measurement channel RC.23 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD and two sided dynamic OCNG pattern OP.2 FDD as described in Annex A.5.1.1 and A.5.1.2.
- Note 2: The minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: DC subcarrier puncturing shall be considered.
- Note 4: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. MPDCCH DCI format 6-0A shall be transmitted in downlink SF#1 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5.

9.8.1.2 TDD

The following requirements apply to UE supporting coverage enhancement. For the parameters specified in Table 9.7.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.23 TDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the

transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI -1) shall be less than or equal to 0.1.

Table 9.8.1.2-1: PUCCH 1-0 static test (TDD)

Parameter		Unit	Test 1	
Bandwidth		MHz		10
PDSCH transmission	n mode			1
	$ ho_{\scriptscriptstyle A}$	dB		0
Downlink power				0
allocation	σ	dB	0	
	δ	dB	0	
Propagation condit antenna configur			AWG	N (1 x 1)
SNR (Note 2		dB	4	5
$\hat{I}_{or}^{(j)}$,	dB[mW/15kHz]	-94	-93
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98
Max number of H transmission				1
Physical channel f				
reporting	0. 00.		PUSCH	I (Note 3)
	PUCCH Report Type			4
Reporting period	rting periodicity		Np	d = 5
cqi-pmi-Configurati			3	
Frequency hop			Dis	abled
Frequency hopping (interval-TDD))		N	I/A
Starting OFDM sy (startSymbolL				3
PDSCH repetition	level			1
ACK/NACK feedbac			Multi	plexing
MPDCCH repetition				1
Beamforming Preco			No pre	ecoding
Precoder update gra for MPDCCH			N	I/A
BL/CE DL subframe comfiguration (fdd- DownlinkOrTddSubframeBitm apBR)		110111		
Note 1: Reference measurement channel RC.23 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD and two sided dynamic OCNG pattern OP. 2 TDD as described in Annex A.5.2.1 and A.5.2.2. Note 2: The minimum requirements shall be fulfilled for at least one of the two SNR(s) and the				

- Note 2: The minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. MPDCCH DCI format 6-0A shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: DC subcarrier puncturing shall be considered.

9.8.2 UE-selected subband CQI

9.8.2.1 FDD and half-duplex FDD

The following requirements apply to UE supporting coverage enhancement. For the parameters specified in Table 9.8.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.8.2.1-2 and by the following

a) the ratio of the throughput obtained when transmitting on the best narrowband reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI

median on a randomly selected narrowband within the set of narrowbands in which MPDCCH is monitored shall be $\geq \gamma$;

The requirements only apply for narrowbands of full size and the random scheduling across the narrowbands is done by selecting a new narrowband in each TTI for FDD and half-duplex FDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the $N_{\rm PRB}$ entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the narrowband size.

Table 9.8.2.1-1 Sub-band test for single antenna transmission (FDD and half-duplex FDD)

Para	meter	Unit	Test 1	
	dwidth	MHz		ИHz
Transmis	sion mode		1 (po	ort 0)
Downlink	$ ho_{\scriptscriptstyle A}$	dB	()
power	$ ho_{\scriptscriptstyle B}$	dB	()
allocation	σ	dB	()
	δ	dB	()
SNR	(Note 3)	dB	5	6
ĺ	(j) or	dB[mW/15kHz]	-93	-92
Λ	$I_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98
Propagati	ion channel		Clause B.2.4 with $a = 1$, $f = 1$	
	ng interval	ms	1	0
	ys for each voband	ms	11, 12,	13, 14
	ing mode		PUSC	CH 2-0
Max numb	er of HARQ		,	1
	nissions of preferred			
	inds (<i>M</i>)		•	1
	narrowbands		4	
	cy hopping		Enabled	
	cy hopping			
	fset		1	
	FDM symbol /mbolBR)		3	
Maximum MPDCCH (mp	n number of I repetitions dcch- epetition)		2	1
MPDCCH	H repetition (Note 6)		1	
	petition level		1	
	narrowband		7 (Note 5)	
	Narrowband)		. (140	/
MPDCC	H hopping iterval-FDD)		•	1
	ubframe		2	.5
configu MPDCCH	ration for H (mpdcch- F-UESS)			
	ing Precoder PDCCH		No pred	conding
Precode	er update		N	/A
granularity for MPDCCH BL/CE DL subframe comfiguration (fdd- DownlinkOrTddSubfram eBitmapBR)			111111111	
(csi-NumR	epetitionCE)	Subframe		1
Note 1: If the UE reports in an available uplink reporting instance at				

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported narrowband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.25 FDD according to Table A.4-1 with one sided and dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.

Note 3: The minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level

Note 4: DC subcarrier puncturing shall be considered

Note 5: For RRC parameter setting, mpdcch-narroband is set to 8.

Note 6: DCI format 6-1A is scheduled in the subframe k2 according to TS36.213 subclause 9.1.5.

Table 9.8.2.1-2 Minimum requirement (FDD and half-duplex FDD)

	Test 1
γ	1.3
UE DL Category	M1, ≥0

9.8.2.2 TDD

The following requirements apply to UE supporting coverage enhancement. For the parameters specified in Table 9.8.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.8.2.2-2 and by the following

a) the ratio of the throughput obtained when transmitting on the best narrowband reported by the UE the corresponding TBS and that obtained when transmitting the TBS indicated by the reported wideband CQI median on a randomly selected narrowband within the set of narrowbands in which MPDCCH is monitored shall be $\geq \gamma$;

The requirements only apply for subbands of full size and the random scheduling across the subbands is done by selecting a new narrowband in each available downlink transmission instance for TDD. The transport block size TBS (wideband CQI median) is that resulting from the code rate which is closest to that indicated by the wideband CQI median and the N_{PRB} entry in Table 7.1.7.2.1-1 of TS 36.213 [6] that corresponds to the narrowband size.

Table 9.8.2.2-1 Sub-band test for single antenna transmission (TDD)

Parameter		Unit	Test 1	
Band		MHz	10 N	ИHz
Transmiss	sion mode		1 (po	ort 0)
Downlink	$ ho_{\scriptscriptstyle A}$	dB	()
power	$ ho_{\scriptscriptstyle B}$	dB	()
allocation	σ	dB)
	δ	dB	()
Uplink d	lownlink		2	2
Special s				
configu	uration		4	1
	Note 3)	dB	5	6
$\hat{I}_o^{(}$	(j) or	dB[mW/15kHz]	-93	-92
N_{c}	(j) oc	dB[mW/15kHz]	-98	-98
			Clause B.2.4 wit	th $\tau_d = 0.45 \mu \text{s}$,
Propagation	on channel			-
Reporting	n interval	ms	a = 1, f	0
	delay	ms		
Reportin	ng mode		23, 24, PUSC	H 2-0
Max numbe			,	1
transm Number of				
subbar	nds (M)		1	
ACK/NACK	K feedback		Multiplexing	
mo			Watapicking	
Numb narrow			4	1
Frequenc			Ena	bled
Frequenc	y hopping		,	
offs Starting OF				
(startSyr	mbolBR)		3	
Maximum MPDCCH				
(mpd			4	
NumRe	petition)			
PDSCH rep	etition level		1	
MPDCCH r (mpdcch-Na			7 (Note 5)	
MPDCCH			,	<u> </u>
inte				
(interva			_	
Start su				
configur MPDCCH	anon ioi (mpdcch-			
startSF-	-UESS)			
Beamforming			No pre	coding
Precoder for MPDCCH				
Precoder update granularity for			l N	/A
MPDCCH			14/	
BL/CE DL subframe				
comfigura DownlinkO			10111	10111
meBitm				
R ^c	CSI	Subframe		1
(csi-NumRe	petitionCE)	orts in an available i		

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink subframe not later than SF#(n-4), this reported subband or wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2:	Reference measurement channel RC.25 TDD according to Table
	A.4-1 with onesided and dynamic OCNG Pattern OP.1/2 TDD as
	described in Annex A.5.2.1/2.
Note 3:	The minimum requirements shall be fulfilled for at least one of the
	two SNR(s) and the respective wanted signal input level.
Note 4:	DC subcarrier puncturing shall be considered
Note 5:	For RRC parameter setting, mpdcch-narroband is set to 8.
Note 6:	DCI format 6-1A is scheduled in the subframe k2 according to
	TS36.213 subclause 9.1.5.
Note 7:	In the case CQI reports and HARQ-ACK collide, CQI reports and
	HARQ-ACK will be multiplexed.

Table 9.8.2.2-2 Minimum requirement (TDD)

	Test 1
γ	1.3
UE Category	M1, ≥0

9.9 CSI reporting for 4Rx UE

9.9.1 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 36.213 [6]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

9.9.1.1 Minimum requirement PUCCH 1-0 with Rank 1 (Cell-Specific Reference Symbols)

9.9.1.1.1 FDD

The following requirements apply to UE Category ≥ 1 . For the parameters specified in Table 9.9.1.1.1-1, using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1 FDD / RC.4 FDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI – 1) shall be less than or equal to 0.1.

Table 9.9.1.1.1-1: PUCCH 1-0 static test (FDD)

Parameter		Unit	Tes	Test 1 Test 2		st 2
Bandwidth		MHz	10			
PDSCH transmission	n mode		1			
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0			
	σ	dB			0	
Propagation condit antenna configur			AWGN (1 x 4)			
SNR (Note 2)		dB	-2	-1	4	5
$\hat{I}_{or}^{(j)}$	$\hat{I}_{or}^{(j)}$		-100	-99	-94	-93
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98		98	
Max number of H transmission					1	
Physical channel f reporting	or CQI		PUCCH Format 2			
PUCCH Report Type					4	
Reporting periodicity		ms	$N_{pd} = 5$			
cqi-pmi-Configuration	onIndex			. =	6	

Reference measurement channel RC.1 FDD according to Table A.4-1 with one sided dynamic Note 1: OCNG Pattern OP.1 FDD as described in Annex A.5.1.1, except for category 1 UE use RC.4 FDD with two sided dynamic OCNG Pattern OP.2 FDD as described in Annex A.5.1.2.

For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) Note 2:

and the respective wanted signal input level.

9.9.1.1.2 **TDD**

The following requirements apply to UE Category ≥1. For the parameters specified in Table 9.9.1.1.2-1, using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported CQI value according to RC.1/RC.4 TDD in Table A.4-1 shall be in the range of ± 1 of the reported median more than 90% of the time. If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median COI is greater than 0.1, the BLER using transport format indicated by (median COI – 1) shall be less than or equal to 0.1.

ACK/NACK feedback mode

Parameter		Unit	Test 1 Test 2		st 2	
Bandwidth		MHz	10			
PDSCH transmission	on mode				1	
Uplink downlink conf	figuration				2	
Special subfra configuration			4			
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0			
	σ	dB			0	
Propagation condition and antenna configuration			AWGN (1 x 4)			
SNR (Note 2	2)	dB	-2	-1	4	5
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-100	-99	-94	-93
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	8	-9	98
Max number of H transmission			1			
Physical channel f reporting	or CQI		PUSCH (Note 3)			
PUCCH Report Type			4			
Reporting period		ms		Np	$_{\rm id} = 5$	
cqi-pmi-ConfigurationIndex					3	

Table 9.9.1.1.2-1: PUCCH 1-0 static test (TDD)

Note 1: Reference measurement channel RC.1 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1, except for category 1 UE use RC.4 TDD with two sided dynamic OCNG Pattern OP.2 TDD as described in Annex A.5.2.2.

Multiplexing

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.

9.9.1.2 Minimum requirement PUCCH 1-1 with Rank 2 (CSI Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

9.9.1.2.1 FDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.9.1.2.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.9.1.2.1-1: PUCCH 1-1 static test (FDD)

Parameter	Unit	Te	st 1	Tes	st 2	
Bandwidth		MHz			10	
PDSCH transmission mode					9	
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
allocation	P_c	dB			-3	
	σ	dB			-3	
Cell-specific reference	ce signals			Antenna	ports 0, 1	
CSI reference si	gnals			Antenna p	orts 15,,18	
CSI-RS periodicity an	d subframe					
offset				ţ	5/1	
$T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$						
CSI reference signal c	onfiguration				0	
Propagation condition a configuration			Clause B.1 (4 x 4)			
Beamforming M			As specified in Section B.4.3			3
CodeBookSubsetRestr			0x0000 0000 0100 0000			
SNR (Note 2	2)	dB	5	6	11	12
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-93	-92	-87	-86
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-9	8
Max number of HARQ t					1	
Physical channel for	· CQI/PMI		PUSCH (Note3)			
reporting	for COI/DMI				2	
PUCCH Report Type for CQI/PMI Physical channel for RI reporting				DIICCH	Format 2	
	PUCCH Report Type for RI			1 00011	3	
Reporting perio		ms	N _{pd} = 5			
CQI delay		ms	7Vpd = 5			
cqi-pmi-Configurati		1113	2			
ri-ConfigInde					1	

- Note 1: Reference measurement channel RC.7 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

9.9.1.2.2 TDD

The following requirements apply to UE Category ≥2. For the parameters specified in table 9.9.1.2.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.9.1.2.2-1: PUCCH 1-1 submode 1 static test (TDD)

$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Parameter	•	Unit	Te	st 1	Tes	st 2
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Bandwidth		MHz			10	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	PDSCH transmission mode					9	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Uplink downlink con	figuration				2	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Special subframe co	nfiguration				4	
allocation P_c dB -6 -6 -6 -6 dB -6 -6 dB -3 -6 dB -3 -6 -6 dB -3 -6 -6 -6 -6 -6 -6 -6 -6		$ ho_{\scriptscriptstyle A}$	dB			0	
CRS reference signals	Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	allocation	P_c	dB			-6	
CSI reference signals Antenna ports 15,,22 CSI-RS periodicity and subframe offset 5/ 3 TCSI-RS periodicity and subframe offset 5/ 3 TCSI-RS Periodicity and subframe offset 5/ 3 CSI reference signal configuration 0 Propagation condition and antenna configuration Clause B.1 (8 x 4) Beamforming Model As specified in Section B.4.3 CodeBookSubsetRestriction bitmap 0x0000 0000 0020 0000 0000 0000 0000 00		σ	dB			-3	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	CRS reference s	ignals			Antenna	a ports 0, 1	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	CSI reference si	gnals					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	CSI-RS periodicity an	d subframe					
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	offset				5	5/ 3	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		CSI reference signal configuration		0			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Propagation condition and antenna		Clause B 1 (8 x 4)			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$, ,			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$							
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$							
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$,	2)	dB		_		_
Max number of HARQ transmissions 1 Physical channel for CQI/PMI reporting PUSCH (Note 3) PUCCH Report Type for CQI/second PMI 2b Physical channel for RI reporting PUSCH PUCCH Report Type for RI/ first PMI 5 Reporting periodicity ms Npd = 5 CQI delay ms 10 or 11 cqi-pmi-ConfigurationIndex 3 ri-ConfigIndex 805 (Note 4)	$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-96	-95	-90	-89
Physical channel for CQI/PMI reporting PUSCH (Note 3) PUCCH Report Type for CQI/second PMI 2b Physical channel for RI reporting PUSCH PUCCH Report Type for RI/ first PMI 5 Reporting periodicity ms Npd = 5 CQI delay ms 10 or 11 cqi-pmi-ConfigurationIndex 3 ri-ConfigIndex 805 (Note 4)	$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	98	-9	98
reporting POSCH (Note 3) PUCCH Report Type for CQI/second PMI 2b Physical channel for RI reporting PUSCH PUCCH Report Type for RI/ first PMI 5 Reporting periodicity ms Npd = 5 CQI delay ms 10 or 11 cqi-pmi-ConfigurationIndex 3 ri-ConfigIndex 805 (Note 4)	Max number of HARQ t	ransmissions				1	
PUCCH Report Type for CQI/second PMI Physical channel for RI reporting PUSCH PUCCH Report Type for RI/ first PMI Reporting periodicity ms Npd = 5 CQI delay ms 10 or 11 cqi-pmi-ConfigurationIndex 3 ri-ConfigIndex 805 (Note 4)	Physical channel for	· CQI/PMI			DUSCE	4 (Note 3)	
PMI 20 Physical channel for RI reporting PUSCH PUCCH Report Type for RI/ first PMI 5 Reporting periodicity ms Npd = 5 CQI delay ms 10 or 11 cqi-pmi-ConfigurationIndex 3 ri-ConfigIndex 805 (Note 4)					FUSCI	i (Note 3)	
PUCCH Report Type for RI/ first PMI 5 Reporting periodicity ms $N_{pd} = 5$ CQI delay ms 10 or 11 cqi-pmi-ConfigurationIndex 3 ri-ConfigIndex 805 (Note 4)				2b			
Reporting periodicity ms $N_{pd} = 5$ CQI delay ms 10 or 11 cqi -pmi-ConfigurationIndex 3 ri -ConfigIndex 805 (Note 4)	Physical channel for RI reporting				PU	JSCH	
Reporting periodicity ms $N_{pd} = 5$ CQI delay ms 10 or 11 cqi -pmi-ConfigurationIndex 3 ri -ConfigIndex 805 (Note 4)						5	
cqi-pmi-ConfigurationIndex 3 ri-ConfigIndex 805 (Note 4)			ms		Np	od = 5	
ri-ConfigIndex 805 (Note 4)			ms				
ri-ConfigIndex 805 (Note 4)	cqi-pmi-Configurat	ionIndex				3	
					805 (Note 4)	

- Note 1: Reference measurement channel RC.7 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

9.9.1.3 Minimum requirement PUCCH 1-1 with Rank 4 (Cell-Specific Reference Symbols)

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

9.9.1.3.1 FDD

The following requirements apply to UE Category ≥5. For the parameters specified in table 9.9.1.3.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI_1 = wideband CQI_0 – Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Parameter Unit Test 1 Test 2 Bandwidth MHz 10 PDSCH transmission mode 4 dB -6 $\rho_{\scriptscriptstyle A}$ Downlink power $\rho_{\scriptscriptstyle B}$ dB -6 allocation dB 0 σ Propagation condition and Clause B.1 (4 x 4) antenna configuration CodeBookSubsetRestriction 0x0002 0000 0000 0000 bitmap SNR (Note 2) 5 dΒ 11 12 -93 -92 -87 -86 $\hat{I}^{(j)}$ dB[mW/15kHz] $N^{\overline{(j)}}$ dB[mW/15kHz] -98 -98 Max number of HARQ transmissions Physical channel for CQI/PMI **PUCCH Format 2** reporting **PUCCH Report Type for** 2 CQI/PMI PUCCH Report Type for RI 3 Reporting periodicity ms $N_{pd} = 5$ cqi-pmi-ConfigurationIndex 6 ri-ConfigIndex 1 (Note 3) Note 1: Reference measurement channel RC.21 FDD according to Table A.4-1 with one sided

Table 9.9.1.3.1-1: PUCCH 1-1 static test (FDD)

dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two S

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 3: It is intended to have UL collisions between RI reports and HARQ-ACK, since the RI reports shall not be used by the eNB in this test.

9.9.1.3.2 TDD

The following requirements apply to UE Category ≥5. For the parameters specified in table 9.9.1.3.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median $CQI_0 - 1$ and median $CQI_1 - 1$ shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median $CQI_0 + 1$ and median $CQI_1 + 1$ shall be greater than or equal to 0.1.

Table 9.9.1.3.2-1: PUCCH 1-1 static test (TDD)

ı	Parameter		Unit	Tes	st 1	Tes	st 2
Bandwidth			MHz			10	
PDSCH	transmissio	on mode				4	
	wnlink conf					2	
	cial subfra					4	
C	onfiguration	1					
Downlink	k power	$ ho_{\scriptscriptstyle A}$	dB			-6	
alloca		$ ho_{\scriptscriptstyle B}$	dB			-6	
		σ	dB			0	
	ation condit na configui				Clause	B.1 (4x4)	
CodeBoo	kSubsetRe bitmap	estriction			0x0002 000	0000 0000	
S	NR (Note 2	2)	dB	5	6	11	12
	$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-93	-93 -92		-86
	$N_{oc}^{(j)}$		dB[mW/15kHz]	-98 -98			98
	umber of F			1			
	ansmission					•	
Physical of	channel for reporting	CQI/PMI		PUSCH (Note 3)			
PUCC	CH Report	Type		2			
	rting period		ms	$N_{\rm pd} = 5$			
	Configurati					3	
ri-	·ConfigInde	£Χ			805 (Note 4)	
	CK feedba					plexing	
	dynamic C	CNG Patte	ent channel RC.21 rn OP.1 TDD as de	scribed in Anı	nex A.5.2.1.		
Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s)							
and the respective wanted signal input level. Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.							
Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions							

9.9.1.4 Minimum requirement PUCCH 1-1 with Rank 3 (CSI Reference Symbols)

between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

The minimum requirements for dual codeword transmission are defined in terms of a reporting spread of the wideband CQI value for codeword #1, and their BLER performance using the transport format indicated by the reported CQI median of codeword #0 and codeword #1. The precoding used at the transmitter is a fixed precoding matrix specified by the bitmap parameter *codebookSubsetRestriction*. The propagation condition assumed for the minimum performance requirement is defined in subclause B.1.

9.9.1.4.1 FDD

The following requirements apply to UE Category ≥5. For the parameters specified in table 9.9.1.4.1-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median CQI_1+1 } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0-1 and median CQI_1-1 shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median CQI_0+1 and median CQI_1+1 shall be greater than or equal to 0.1.

Table 9.9.1.4.1-1: PUCCH 1-1 static test (FDD)

Parameter	Unit	Tes	st 1	Tes	st 2		
Bandwidth	MHz			10			
PDSCH transmission				9			
	$ ho_{\scriptscriptstyle A}$		0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0		
allocation	P_{c}	dB	-3				
	σ	dB			-3		
Cell-specific reference	ce signals				ports 0, 1		
CSI reference si				Antenna p	orts 15,,18		
CSI-RS periodicity and offset $T_{\text{CSI-RS}}$ / $\Delta_{\text{CSI-RS}}$				Ę	5/1		
CSI reference signal c					0		
Propagation condition and antenna configuration			Clause B.1 (4 x 4)				
Beamforming Model			As specified in Section B.4.3				
CodeBookSubsetRestr	iction bitmap		0x0000 0020 0000 0000				
SNR (Note 2	2)	dB	[5]	[6]	[11]	[12]	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	[-93]	[-92]	[-87]	[-86]	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-9	18	-9	18	
Max number of HARQ to					1		
Physical channel for reporting	CQI/PMI		PUSCH (Note3)				
PUCCH Report Type for CQI/PMI					2		
Physical channel for RI reporting				PUCCH	Format 2		
PUCCH Report Type for RI					3		
Reporting periodicity		ms		Np	d = 5		
CQI delay		ms	8				
cqi-pmi-Configurati	ionIndex				2		
ri-ConfigInde	ex		·	·	1		

Note 1: Reference measurement channel RC.22 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.

Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.

9.9.1.4.2 TDD

The following requirements apply to UE Category ≥5. For the parameters specified in table 9.9.1.4.2-1, and using the downlink physical channels specified in tables C.3.2-1 and C.3.2-2, the reported offset level of the wideband spatial differential CQI for codeword #1 (Table 7.2-2 in TS 36.213 [6]) shall be used to determine the wideband CQI index for codeword #1 as

wideband CQI₁ = wideband CQI₀ - Codeword 1 offset level

The wideband CQI_1 shall be within the set {median CQI_1 -1, median CQI_1 , median $CQI_1 +1$ } for more than 90% of the time, where the resulting wideband values CQI_1 shall be used to determine the median CQI values for codeword #1. For both codewords #0 and #1, the PDSCH BLER using the transport format indicated by the respective median $CQI_0 - 1$ and median $CQI_1 - 1$ shall be less than or equal to 0.1. Furthermore, for both codewords #0 and #1, the PDSCH BLER

using the transport format indicated by the respective median $CQI_0 + 1$ and median $CQI_1 + 1$ shall be greater than or equal to 0.1.

Table 9.9.1.4.2-1: PUCCH 1-1 static test (TDD)

Parameter		Unit	Test 1 Test 2			t 2
Bandwidth	Bandwidth		10			
PDSCH transmission mode					9	
Uplink downlink config	guration				2	
Special subframe confi	guration				4	
	$ ho_{\scriptscriptstyle A}$	dB			0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB			0	
allocation	P_c	dB			-3	
	σ	dB		,	-3	
CRS reference sig	nals			Antenna	ports 0, 1	
CSI reference sign	nals			Antenna po	orts 15,,18	
CSI-RS periodicity and	subframe					
offset				5	5/ 3	
$T_{ extsf{CSI-RS}}$ / $\Delta_{ extsf{CSI-RS}}$						
CSI reference signal cor			0			
	ropagation condition and antenna		Clause B.1 (4 x 4)			
configuration Beamforming Model			` '			,
			As specified in Section B.4.3 0x0000 0020 0000 0000			
CodeBookSubsetRestrict SNR (Note 2)	lion bilmap	dB				
1 1		uБ	-93	-92	-87	12 -86
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-93	-92	-01	-00
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	1	-9	8
Max number of HARQ tra	nsmissions				1	
Physical channel for C	QI/PMI			DIISCL	I (Note 3)	
reporting				FUSCI	i (Note 3)	
PUCCH Report Type for					2	
Physical channel for RI				PU	SCH	
PUCCH Report Type for RI					3	
Reporting periodicity		ms			d = 5	
CQI delay		ms	10 or 11			
cqi-pmi-Configuration			3			
ri-ConfigIndex			805 (Note 4)			
ACK/NACK feedback mode Multiplexing				olexina		

- Note 2: For each test, the minimum requirements shall be fulfilled for at least one of the two SNR(s) and the respective wanted signal input level.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#7 and #2.
- Note 4: RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification.

9.9.2 CQI reporting definition under fading conditions

9.9.2.1 Minimum requirement PUCCH 1-0 (Cell-Specific Reference Symbol) for enhanced receiver Type A

The purpose of the test is to verify that the reporting of the channel quality is based on the receiver of the enhanced Type A. Performance requirements are specified in terms of the relative increase of the throughput obtained when the transport format is that indicated by the reported CQI subject to an interference model compared to the case with a white Gaussian noise model, and a requirement on the minimum BLER of the transmitted transport formats indicated by the reported CQI subject to an interference model.

9.9.2.1.1 FDD

For the parameters specified in Table 9.9.2.1.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.9.2.1.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be $\geq \gamma$;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.9.2.1.1-1 Fading test for single antenna (FDD)

Parameter	Unit	Cell 1	Cell 2	
Bandwidth	MHz	10 MHz		
Transmission mode		1 (p	ort 0)	
Cyclic Prefix		Normal	Normal	
Cell ID		0	1	
SINR (Note 8)	dB	-4	N/A	
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A	
Propagation channel		EPA5	Static (Note 7)	
Correlation and antenna configuration		Low (1 x 4)	(1 x 4)	
DIP (Note 4)	dB	N/A	-0.41	
Reference		Note 2	R.2 FDD	
measurement channel		Note 2	K.2 FDD	
Reporting mode		PUCCH 1-0	N/A	
Reporting periodicity	ms	$N_{pd} = 2$	N/A	
CQI delay	ms	8	N/A	
Physical channel for		PUSCH (Note	N/A	
CQI reporting		3)	·	
PUCCH Report Type		4	N/A	
cqi-pmi- ConfigurationIndex		1	N/A	
Max number of HARQ transmissions		1	N/A	

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.1 FDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1 and RC.4 FDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 FDD as described in Annex A.5.1.1/2.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1, #3, #7 and #9 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#5, #7, #1 and #3.
- Note 4: The respective received power spectral density of each interfering cell relative to N_{oc} ' is defined by its associated DIP value as specified in clause B.5.1.
- Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.
- Note 6: Both cells are time-synchronous.
- Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.
- Note 8: SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Table 9.9.2.1.1-2 Minimum requirement (FDD)

γ	1.8
UE Category	≥1

9.9.2.1.2 TDD

For the parameters specified in Table 9.9.2.1.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.9.2.1.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be $\geq \gamma$;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.9.2.1.2-1 Fading test for single antenna (TDD)

Parameter	Unit	Cell 1	Cell 2				
Bandwidth	MHz	10 MHz					
Transmission mode		1 (po	ort 0)				
Uplink downlink			2				
configuration		•					
Special subframe			4				
configuration							
Cyclic Prefix		Normal	Normal				
Cell ID		0	1				
SINR (Note 8)	dB	-4	N/A				
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98				
Propagation channel		EPA5	Static (Note 7)				
Correlation and		Low (1 x 4)	(1 x 4)				
antenna configuration		LOW (1 X 4)	(1 X 4)				
DIP (Note 4)	dB	N/A	-0.41				
Reference		Note 2	R.2A TDD				
measurement channel		NOIG Z	N.ZA IDD				
Reporting mode		PUCCH 1-0	N/A				
Reporting periodicity	ms	$N_{pd} = 5$	N/A				
CQI delay	ms	10 or 11	N/A				
Physical channel for		PUSCH (Note	N/A				
CQI reporting		3)	·				
PUCCH Report Type		4	N/A				
cqi-pmi-		3	N/A				
ConfigurationIndex		3	IN//A				
Max number of HARQ		1	N/A				
transmissions		'	1 4// 1				
ACK/NACK feedback		Multiplexing	N/A				
mode		3 1					
	Note 1: If the UE reports in an available uplink reporting instance at						

- subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)
- Note 2: Reference measurement channel RC.1 TDD according to Table A.4-1 for Category 2-8 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1 and RC.4 TDD according to Table A.4-1 for Category 1 with one/two sided dynamic OCNG Pattern OP.1/2 TDD as described in Annex A.5.2.1/2.
- Note 3: To avoid collisions between CQI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#7 and #2.
- Note 4: The respective received power spectral density of each interfering cell relative to N_{oc} ' is defined by its associated DIP value as specified in clause B.5.1.
- Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. The number of the CRS ports in both cells is the same. Intefering cell is fully loaded.
- Note 6: Both cells are time-synchronous.
- Note 7: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.
- Note 8: SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause 8.1.1.

Table 9.3.5.1.2-2 Minimum requirement (TDD)

γ	1.8
UE Category	≥1

9.9.2.2 Minimum requirement PUCCH 1-1 (CSI Reference Symbol) for enhanced receiver Type A

The purpose of the test is to verify that the reporting of the channel quality is based on the receiver of the enhanced Type A. Performance requirements are specified in terms of the relative increase of the throughput obtained when the transport format is that indicated by the reported CQI subject to an interference model compared to the case with a white Gaussian noise model, and a requirement on the minimum BLER of the transmitted transport formats indicated by the reported CQI subject to an interference model.

9.9.2.2.1 FDD

For the parameters specified in Table 9.9.2.2.1-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in Table 9.9.2.2.1-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be $\geq \gamma$;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.9.2.2.1-1 Fading test for single antenna (FDD)

Parameter	Unit	Cell 1	Cell 2
Bandwidth	MHz	10	MHz
Transmission mode			9
Cyclic Prefix		Normal	Normal
Cell ID		0	1
SINR (Note 8)	dB	-4	N/A
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	N/A
Propagation channel		EPA5	Static (Note 7)
Correlation and antenna configuration		Low (2 x 4)	(1 x 4)
Beamforming Model		As specified in Section B.4.3 (Note 9, 10)	N/A
DIP (Note 4)	dB	N/A	-0.41
Cell-specific reference signals		Antenna ports 0,1	Antenna port 0
CSI reference signals		Antenna ports 15,16	N/A
CSI-RS periodicity and subframe offset		5/1	N/A
CSI-RS reference signal configuration		2	N/A
Zero-power CSI-RS configuration IcsI-RS / ZeroPowerCSI-RS bitmap	Subframes / bitmap	N/A	1 / 0010000000000 000
CodeBookSubsetRestr iction bitmap		001111	N/A
Reference measurement channel		Note 2	R.2 FDD
Reporting mode		PUCCH 1-1	N/A
Reporting periodicity	ms	$N_{pd} = 5$	N/A
CQI delay	ms	8	N/A
Physical channel for CQI/PMI reporting		PUSCH (Note 3)	N/A
PUCCH Report Type for CQI/PMI		2	N/A
PUCCH channel for RI reporting		PUCCH Format 2	N/A
PUCCH Report Type for RI		3	N/A
cqi-pmi- ConfigurationIndex		2	N/A
ri-ConfigIndex		1	N/A
Max number of HARQ transmissions		1	N/A

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.11 FDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.

Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#0 and #5.

Note 4: The respective received power spectral density of each interfering cell relative to N_{oc} ' is defined by its associated DIP value as specified in clause B.5.1.

Note 5: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Intefering cell is fully loaded.

Note 6:	Both cells are time-synchronous.
Note 7:	Static channel is used for the interference model. In case for white
	Gaussian noise model Cell 2 is not present.
Note 8:	SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause
	8.1.1.
Note 9:	The precoder in clause B.4.3 follows UE recommended PMI.
Note 10:	
	subrame SF#n based on PMI estimation at a downlink SF not later
	than SF#(n-4), this reported PMI cannot be applied at the eNB
	downlink before SF#(n+4).
	downlink belote of #(II) =).

Table 9.9.2.2.1-2 Minimum requirement (FDD)

γ	1.8
UE Category	≥2

9.9.2.2.2 TDD

For the parameters specified in Table 9.9.2.2.2-1, and using the downlink physical channels specified in Annex C, the minimum requirements are specified in 9.9.2.2.2-2 and by the following

- a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be $\geq \gamma$;
- b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified DIP, the average BLER for the indicated transport formats shall be greater than or equal to 2%.

Table 9.9.2.2.2-1

Fading test for single				
antenna	Unit	Cell 1	Cell 2	
(TDD)Parameter				
Bandwidth	MHz	101	MHz	
Transmission mode		(9	
Uplink downlink			2	
configuration		<i>'</i>	_	
Special subframe			4	
configuration				
Cyclic Prefix		Normal	Normal	
Cell ID		0	1	
SINR (Note 8)	dB	-4	N/A	
$N_{oc}^{(j)}$	dB[mW/15kHz]	-98	-98	
Propagation channel		EPA5	Static (Note 7)	
Correlation and		L avv (0 v 4)		
antenna configuration		Low (2 x 4)	(1 x 4)	
		As specified in		
Beamforming Model		Section B.4.3	N/A	
		(Note 10, 11)		
DIP (Note 4)	dB	N/A	-0.41	
Cell-specific reference		Antenna ports	Antenna port 0	
signals		0,1		
CSI reference signals		Antenna ports 15,16	N/A	
CSI-RS periodicity and		15,10		
subframe offset		5/3	N/A	
CSI-RS reference				
signal configuration		2	N/A	
Zero-power CSI-RS				
configuration			3 /	
/csi-rs /	Subframes /	N/A	001000000000	
ZeroPowerCSI-RS	bitmap		0000	
bitmap				
CodeBookSubsetRestr		001111	N/A	
iction bitmap		001111	IN/A	
Reference		Note 2	R.2A TDD	
measurement channel		Note 2	N.ZA IDD	
Reporting mode		PUCCH 1-1	N/A	
Reporting periodicity	ms	$N_{pd} = 5$	N/A	
CQI delay	ms	10	N/A	
Physical channel for		PUSCH (Note	N/A	
CQI/PMI reporting		3)	IN//A	
PUCCH Report Type		2	N/A	
for CQI/PMI			14/71	
Physical channel for RI		PUCCH	N/A	
reporting		Format 2		
PUCCH Report Type		3	N/A	
for RI		-		
cqi-pmi-		3	N/A	
ConfigurationIndex		OUE (Note O)	N/A	
ri-ConfigIndex Max number of HARQ		805 (Note 9)	IN/A	
transmissions		1	N/A	
ACK/NACK feedback		Multiploving	N/A	
mode		Multiplexing		
Note 1. If the LIE rene	rte in an available i	nlink ranarting ina	4	

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on CQI estimation at a downlink SF not later than SF#(n-4), this reported wideband CQI cannot be applied at the eNB downlink before SF#(n+4)

Note 2: Reference measurement channel RC.11 TDD according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH

Note 4:	DCI format 0 shall be transmitted in downlink SF#3 and #8 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#2 and #7. The respective received power spectral density of each interfering cell relative to N_{oc} is defined by its associated DIP value as
Note 5:	specified in clause B.5.1. Two cells are considered in which Cell 1 is the serving cell and Cell
	2 is the interfering cell. Intefering cell is fully loaded.
Note 6:	Both cells are time-synchronous.
Note 7:	Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.
Note 8:	SINR corresponds to \hat{E}_s/N_{oc} of Cell 1 as defined in clause
	8.1.1.
Note 9:	RI reporting interval is set to the maximum allowable length of 160ms to minimise collisions between RI, CQI/PMI and HARQ-ACK reports. In the case when all three reports collide, it is expected that CQI/PMI reports will be dropped, while RI and HARQ-ACK will be multiplexed. At eNB, CQI report collection shall be skipped every 160ms during performance verification and the reported CQI in subframe SF#7 of the previous frame is applied in downlink subframes until a new CQI (after CQI/PMI dropping) is available.
Note 10:	The precoder in clause B.4.3 follows UE recommended PMI.
Note 11:	If the UE reports in an available uplink reporting instance at
	subrame SF#n based on PMI estimation at a downlink SF not later
	than SF#(n-4), this reported PMI cannot be applied at the eNB
	downlink before SF#(n+4).

Table 9.9.2.2.2-2 Minimum requirement (TDD)

γ	1.8
UE Category	≥2

9.9.3 Reporting of Precoding Matrix Indicator (PMI) for 4Rx UE

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 9 with 8 TX are specified in terms of the ratio

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of γ , for PUSCH 3-1 single PMI $t_{follow1,follow2}$ is 70% of the maximum throughput obtained at $SNR_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t_{md1,md2}$ is the throughput measured at $SNR_{follow1,follow2}$ with random precoding .

9.9.3.1 Minimum requirement PUSCH 3-1 (CSI Reference Symbol)

9.9.3.1.1 TDD

For the parameters specified in Table 9.9.3.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.3.1.1-2.

Table 9.9.3.1.1-1: PMI test for single-layer (TDD)

Parameter		Unit	Test 1		
Band	lwidth	MHz	10		
	sion mode		9		
	downlink uration		1		
Special s	subframe uration		4		
	on channel		EVA5		
	granularity	PRB	50		
	onfiguration		8 x 4		
	n modeling		High, Cross polarized		
	c reference nals		Antenna ports 0,1		
	nce signals		Antenna ports 15,,22		
Beamform	ning model		Annex B.4.3		
CSI-RS per subfram	riodicity and ne offset		5/ 4		
T _{CSI-RS}	/ Δcsi-rs				
	reference nfiguration		0		
	SubsetRestr bitmap		0x0000 0000 001F FFE0 0000 0000 FFFF		
	$ ho_{\scriptscriptstyle A}$	dB	0		
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0		
allocation	Pc	dB	-6		
	σ	dB	-3		
	(j) oc	dB[mW/15kHz]	-98		
	ng mode		PUSCH 3-1		
	g interval	ms	5		
	y (Note 2)	ms	10		
Measurem	ent channel		R.45-2 TDD		
	Pattern		OP.1 TDD		
transm	er of HARQ issions		4		
	icy version equence		{0,0,1,2}		
ACK/NACI	K feedback ode		Multiplexing		
Note 1:	or random p	recoder selection, th			
8	shall be updat	ted in each TTI (1 m orts in an available u	ns granularity).		
£ 2	instance at subrame SF#n based on PMI estimation at a downlink SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4).				
t	CQI shall be t	format 0 with a trigg- ransmitted in downlodic CQI/PMI/RI to b 3 and #8.	ink SF#4 and #9		
Note 4: Randomization of the principle beam direction shall be used as specified in B.2.3A.4					

Table 9.9.3.1.1-2: Minimum requirement (TDD)

Parameter	Test 1
γ	2.5
UE Category	≥2

9.9.4 Reporting of Rank Indicator (RI)

The purpose of this test for 4Rx UEs is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI (CQI) reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission. Transmission mode 4 is used with the specified CodebookSubSetRestriction in section 9.9.4.1, transmission mode 9 is used with the specified CodebookSubSetRestriction in section 9.9.4.2.

For the fixed rank 1 transmission with 2 Tx ports the RI and PMI reporting is restricted to two single-layer precoders, For fixed rank 2 transmission with 2 Tx ports the RI and PMI reporting is restricted to one two-layer precoder. For the follow RI transmission for rank 1 and 2 and 2 Tx ports the RI and PMI reporting is restricted to select the union of these precoders.

For the fixed rank 2 transmission with 4 Tx ports the RI and PMI reporting is restricted to any 2 Layer precoder, for the follow RI transmission the RI and PMI reporting is not restricted at all.

Channels with low and high correlation are used to ensure that RI reporting reflects the channel condition.

9.9.4.1 Minimum requirement (Cell-Specific Reference Symbols)

9.9.4.1.1 FDD

The minimum performance requirement in Table 9.9.4.1.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.9.4.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.4.1.1-2.

Table 9.9.4.1.1-1: RI Test (FDD)

Parameter		Unit	Test 1 Test 2 Test 3 Test			Test 4
Bandwidth		MHz	10			
PDSCH transmission mode			4			
$ ho_{\scriptscriptstyle A}$		dB		-3		
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-3		-6
	σ	dB		0		3
Propagation condit antenna configur				2 x 4 EPA5		4 x 4 EPA5
Cell-specific reference	e signals			enna ports 0, 1		Antenna ports 0-3
CodeBookSubsetRe bitmap	estriction		000011 for fixed RI = 1 010000 for fixed RI = 2 010011 for UE reported RI		Note 6	
Antenna correla	ation		Low	Low	High	Low
RI configuration	on				Fixed RI=1 and follow RI	Fixed RI=2 and follow RI
SNR		dB	-4	16	16	25
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	-98
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-102	-82	-82	-73
Maximum number of transmission				1		
Reporting mo	de			PUCCH 1-1 ((Note 4)	
Physical channel for reporting	CQI/PMI			PUCCH Fo	rmat 2	
PUCCH Report Ty CQI/PMI	ype for			2		
Physical channel reporting	for RI		PUSCH (Note 3)			
PUCCH Report Type for RI		3				
Reporting period		ms	N _{pd} = 5			
PMI and CQI d		ms	8			
cqi-pmi-Configurati			6			
ri-Configuration	nInd		1 (Note 5)			

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.2 FDD / RC.21 FDD respectively for Test 1-3 / 4 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between RI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic RI to multiplex with the HARQ-ACK on PUSCH in uplink subframe SF#8 and #3.
- Note 4: The bit field for precoding information in DCI format 2 shall be mapped as:
 - For reported RI = 1 and PMI = 0 >> precoding information bit field index = 1
 - For reported RI = 1 and PMI = 1 >> precoding information bit field index = 2
 - For reported RI = 2 and PMI = 0 >> precoding information bit field index = 0
- Note 5: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.
- Note 6: The following precoders are allowed in Test 4:

"0x0000 0000 FFFF 0000" for RI=2

"0xFFFF FFFF FFFF" for UE reported RI

Table 9.9.4.1.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3	Test 4
21	N/A	1.05	0.9	N/A
72	1	N/A	N/A	1.1
UE Category	≥2	≥2	≥2	≥5

9.9.4.1.2 TDD

The minimum performance requirement in Table 9.9.4.1.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.9.4.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.4.1.2-2.

Table 9.9.4.1.2-1: RI Test (TDD)

Parameter		Unit	Test 1 Test 2 Test 3 Test			Test 4
Bandwidth		MHz	10			
PDSCH transmission mode			4			
Danielinkanina	$ ho_{\scriptscriptstyle A}$	dB		-3		-6
Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB		-3		-6
ano cano	σ	dB		0		
Uplink downlink conf	iguration			2		
Special subfra configuration	า			4		
Propagation condit antenna configur	ion and ation		2 x 4 EPA5 4 x 4 EF			4 x 4 EPA5
Cell-specific reference	e signals		Antenna ports 0, 1		Antenna ports 0-3	
CodeBookSubsetRestriction bitmap			000011 for fixed RI = 1 010000 for fixed RI = 2 010011 for UE reported RI			Note 4
Antenna correla	ation		Low	Low	High	Low
RI configuration	on		Fixed RI=2 and follow RI	Fixed RI= 1 and follow RI	Fixed RI=1 and follow RI	Fixed RI=2 and follow RI
SNR		dB	-4	16	16	25
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	-98
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-102 -82 -82		-73	
	aximum number of HARQ transmissions					
Reporting mod	Reporting mode		PUSCH 3-1 (Note 3)			
	Reporting interval		5			
PMI and CQI do		ms	10 or 11			
ACK/NACK feedback	ck mode		Bundling			

Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: Reference measurement channel RC.2 TDD / RC.21 TDD respectively for Test 1-3 / 4 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.

Note 3: Reported wideband CQI and PMI are used and sub-band CQI is discarded.

Note 4: The following precoders are allowed in Test 4:

"0x0000 0000 FFFF 0000" for RI=2

"0xFFFF FFFF FFFF FFFF" for UE reported RI

Table 9.9.4.1.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3	Test 4
71	N/A	1.05	0.9	N/A
72	1	N/A	N/A	1.1
UE Category	≥2	≥2	≥2	≥5

9.9.4.2 Minimum requirement (CSI Reference Symbols)

9.9.4.2.1 FDD

The minimum performance requirement in Table 9.9.4.2.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.9.4.2.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.4.2.1-2.

Table 9.9.4.2.1-1: RI Test (FDD)

Parameter		Unit	Test 1	Test 2	Test 3	Test 4	
Bandwidth		MHz		10			
PDSCH transmission mode				9			
$ ho_{\scriptscriptstyle A}$		dB	0				
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0				
allocation	Pc	dB	0 -			-3	
	σ	dB		0			
	Propagation condition and antenna configuration		2 x 4 EPA5			4 x 4 EPA5	
Cell-specific reference			Antenna ports 0				
Beamforming M			As specified in Section B.4.3				
CSI reference signals			Antenna ports 15, 16			Antenna ports 15-18	
CSI-RS periodicity and subframe offset $T_{\text{CSI-RS}} / \Delta_{\text{CSI-RS}}$			5/1				
CSI reference si configuration				6			
CodeBookSubsetRestriction bitmap			000011 for fixed RI = 1 Note 5 010000 for fixed RI = 2 010011 for UE reported RI				
Antenna correla	ation		Low Low High Low				
RI configuration			Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI	Fixed RI=2 and follow RI	
SNR		dB	-4	16	16	25	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	-98	
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-102	-82	-82	-73	
Maximum number o			1				
Reporting mo	de		PUCCH 1-1				
Physical channel for reporting	CQI/PMI		PUSCH (Note 3)				
PUCCH Report Ty CQI/PMI	ype for		2				
Physical channel reporting	for RI		PUCCH Format 2				
PUCCH Report Typ	e for RI		3				
Reporting period			$N_{pd} = 5$				
PMI and CQI de	elay	ms	8				
cqi-pmi-ConfigurationIndex				2			
ri-ConfigurationInd 1 (Note 4)							

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.9 FDD / RC.9B FDD respectively for Test 1-3 / 4 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 FDD as described in Annex A.5.1.1.
- Note 3: To avoid collisions between CQI/ PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#1 and #6 to allow periodic CQI/ PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#0 and #5.
- Note 4: To avoid the ambiguity of TE behaviour when applying CQI and PMI during rank switching, RI reports are to be applied at the TE with one subframe delay in addition to Note 1 to align with CQI and PMI reports.
- Note 5: The following precoders are allowed in Test 4:

"0x0000 0000 FFFF 0000" for RI=2

"0xFFFF FFFF FFFF" for UE reported RI

Table 9.9.4.2.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3	Test 4
21	N/A	1.05	0.9	N/A
72	1	N/A	N/A	1.1
UE Category	≥2	≥2	≥2	≥5

9.9.4.2.2 TDD

The minimum performance requirement in Table 9.9.4.2.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 9.9.4.2.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.9.4.2.2-2.

Table 9.9.4.2.2-1: RI Test (TDD)

Parameter		Unit	Test 1	Test 2	Test 3	Test 4
Bandwidth		MHz		10		
PDSCH transmission mode			9			
	$ ho_{\scriptscriptstyle A}$	dB	0			
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0			
allocation	Pc	dB	0			-3
	σ		0			-3
Uplink downlink conf			1			
configuration	Special subframe configuration		4			
Propagation condition and antenna configuration			2 x 4 EPA5 4 x 4 E			4 x 4 EPA5
Cell-specific reference	ce signals		Antenna ports 0			
CSI reference si	CSI reference signals		Antenna ports 15, 16			Antenna ports 15-18
Beamforming M	lodel			As specified in Se	ection B.4.3	•
CSI reference s configuration	n		4			
CSI-RS periodicity and subframe offset T _{CSI-RS} / Δ _{CSI-RS}			5/4			
CodeBookSubsetRestriction bitmap			000011 for fixed RI = 1 010000 for fixed RI = 2 010011 for UE reported RI			Note 4
Antenna correla	ation		Low	Low	High	Low
RI configuration			Fixed RI=2 and follow RI	Fixed RI=1 and follow RI	Fixed RI=1 and follow RI	Fixed RI=2 and follow RI
SNR	SNR		-4	16	16	25
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98	-98	-98	-98
$\hat{I}_{or}^{(j)}$		dB[mW/15kHz]	-102	-82	-82	-73
Maximum number o			1			
Reporting mo	de		PUCCH 1-1			
Physical channel for reporting	CQI/ PMI		PUSCH (Note 3)			
PUCCH report type PMI	for CQI/		2			
Physical channel reporting	for RI		PUCCH Format 2			
Reporting period		ms	$N_{\rm pd} = 5$			
PMI and CQI d		ms	10			
ACK/NACK feedback			Bundling			
cqi-pmi-ConfigurationIndex			4			
ri-Configuration	nInd	<u> </u>		1		<u> </u>

- Note 1: If the UE reports in an available uplink reporting instance at subframe SF#n based on PMI and CQI estimation at a downlink subframe not later than SF#(n-4), this reported PMI and wideband CQI cannot be applied at the eNB downlink before SF#(n+4).
- Note 2: Reference measurement channel RC.9 TDD / RC.9B TDD respectively for Test 1-3 / 4 according to Table A.4-1 with one sided dynamic OCNG Pattern OP.1 TDD as described in Annex A.5.2.1.
- Note 3: To avoid collisions between CQI/PMI reports and HARQ-ACK it is necessary to report both on PUSCH instead of PUCCH. PDCCH DCI format 0 shall be transmitted in downlink SF#4 and #9 to allow periodic CQI/PMI to multiplex with the HARQ-ACK on PUSCH in uplink SF#3 and #8.
- Note 4: The following precoders are allowed in Test 4:

"0x0000 0000 FFFF 0000" for RI=2

"0xFFFF FFFF FFFF" for UE reported RI

Table 9.9.4.2.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3	Test 4
21	N/A	1.05	0.9	N/A
72	1	N/A	N/A	1.1
UE Category	≥2	≥2	≥2	≥5

9.10 Reporting of CSI-RS Resource Indicator (CRI)

The purpose of this test is to verify that the reported CSI-RS Resource Indicator is accurate. The accuracy of CRI reporting is determined by:

- a) The ratio of the throughput obtained when transmitting based on the reported CRI and fixed precoder with multiple CSI-RS resources configured compared to that obtained when transmitting based on the fixed precoder with one CSI-RS resource configured: $\gamma = \frac{t_{ue,follow_CRI,fixed_PMI}}{t_{fixed_CRI,fixed_PMI}}$
 - $t_{ue,follow_CRI,fixed_PMI}$ is [70%] of the maximum throughput obtained at $SNR_{ue,follow_CRI,fixed_PMI}$ using fixed precoder and power scaling factor according to UE reported CRI value with multiple CSI-RS resources configured
 - t_{fixed_CRI,fixed_PMI} is throughput obtained at SNR_{ue,follow_CRI,fixed_PMI} using fixed precoder and power scaling factor according to the one configured CSI-RS resource
 - SNR_{ue, follow_CRI, fixed_PMI} is specified based on CRS RE power
- b) Each candidate CRI value among 0, 1,..., K-1 shall be reported at least α % of the time at $SNR_{ue,follow_CRI,fixed_PMI}$ with multiple CSI-RS resources configured
 - The number of configured CSI-RS resources K is specific to a test.

9.10.1 Minimum requirement (PUSCH 3-1)

9.10.1.1 FDD

For the parameters specified in Table 9.10.1.1-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.10.1.1-2.

Table 9.10.1.1-1: CRI Test (FDD)

Parameter		Unit	Test 1-1 (K,N)=(2,8)	Test 1-2 (K,N)=(2,16)	Test 1-3 (K,N)=(4,32)	Test 1-4 (K,N)=(8,64)
Bandwidth		MHz		,	10	
Transmission			9			
Propagation ch			EPA5			
Beamforming r		555			x B.4.6	
Precoding gran		PRB			50	I
Correlation and a configuration (N			4x2 XP High	8x2 XP High	8x2 XP High	8x2 XP High
Cell-specific referer				Antenna	ports 0,1	
eMIMO-Typ					ss B	
Number of NZP-CSI r (Note 3)			2 for following CRI	2 for following CRI	4 for following CRI	8 for following CRI
, ,	D. L. inst		1 for fixed CRI	1 for fixed CRI	1 for fixed CRI	1 for fixed CRI
NZP-CSI-RS-II legacyCSRI			{0,1} {0,0}	{0,1} {0,0}	{0,1,2,3 } {0,0,0,0}	{0,1,2,3,4,5,6,7} {0,0,0,0,0,0,0,0,0}
CSI reference signal			1 . 1			
List	_		{0,1}	{0,1}	{0,1,2,3 }	{0,1,2,3,0,1,2,3}
Number of CSI-F (Nk)	RS ports		{4,4}	{8,8}	{8,8,8,8}	{8,8,8,8,8,8,8}
CSI-RS-SubframeC	Config List		{1,1}	{1,1}	{1,1,1,1}	{1,1,1,1,2,2,2,2}
CodeBookSubsetRestriction with ID=0			0x 0000 00000000 0001	0x 0000 0000 0000 0020 0000 0000 0001	0x 0000 0000 0000 0020 0000 0000 0001	0x 0000 0000 0000 0020 0000 0000 0001
alternativeCodeBookEr r12	nabledFor4TX-		FALSE	N/A	N/A	N/A
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0	0	0	0
allocation	Pc	dB	-3	-6	-6	-6
	σ	dB	-3	-3	-3	-3
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98			
Reporting me					CH 3-1	
Reporting inte		ms			5	
CRI Delay		ms ms			8	
	PMI delay		D 504 / 505		8	D 504 0 505
Measurement c			R.50A-1 FDD	R.50A-2 FDD	R.50A-2 FDD	R.50A-3 FDD
OCNG Patte				OP.1	I FDD	
Rank Number of	PDSCH				1	T
Scheduled PDS0			SF 0,2,3,4,7,8,9	SF 0,2,3,4,7,8,9	SF 0,2,3,4,7,8,9	SF 0,3,4,8,9
Max number of HARQ					4	
Redundancy version sequence	_			{0,1	,2,3}	

Note 1: If the UE reports in an available uplink reporting instance at subrame SF#n based on CRI/PMI estimation at a downlink SF not later than SF#(n-4), this reported CRI/PMI cannot be applied at the eNB downlink before SF#(n+4).

Note 2: PDSCH _RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the receiver.

Note 3: When one CSI-RS resource configured, the configurations according to NZP-CSI-RS-ID = 0 are configured.

Table 9.10.1.1-2: Minimum requirement (FDD)

	Test 1-1	Test 1-2	Test 1-3	Test 1-4
	1.2	1.2	1.3	1.35
	40	40	20	10
UE Category	≥2	≥2	≥2	≥2

Note1: According to UE capability configuration list for the maximum number of NZP CSI-RS resource Kmax and the maximum number of total NZP CSI-RS ports N in each K =2,.., Kmax: if UE supports the combination of (K,N) =(8,64), then test 1-4 is applicable; else if UE supports the combination of (K,N) =(4,32), then test 1-3 is applicable; else if UE supports the combination of (K,N) =(2,16), then test 1-2 is applicable; otherwise test 1-1 is applicable.

9.10.1.2 TDD

For the parameters specified in Table 9.10.1.2-1, and using the downlink physical channels specified in Annex C.3.2, the minimum requirements are specified in Table 9.10.1.2-2.

Table 9.10.1.2-1: CRI Test (TDD)

Paramete	er	Unit	Test 1-1 (K,N)=(2,8)	Test 1-2 (K,N)=(2,16))	Test 1-3 (K,N)=(4,32)	Test 1-4 (K,N)=(8,64)	
Bandwidth		MHz	, , , , ,	10			
Transmission	mode			9			
Uplink downlink co				2			
Special subframe c			4				
Propagation cl					PA5		
Beamforming					x B.4.6		
Precoding gran		PRB			50		
Correlation and configuration (Note 1)		4x2 XP High	8x2 XP High	8x2 XP High	8x2 XP High	
Cell-specific refere					ports 0,1		
eMIMO-Ty	pe				ss B		
Number of NZP-CSI (Note 3)			2 for following CRI	2 for following CRI	4 for following CRI	8 for following CRI	
` ,			1 for fixed CRI	1 for fixed CRI	1 for fixed CRI	1 for fixed CRI	
NZP-CSI-RS-I			{0,1}	{0,1}	{0,1,2,3 }	{0,1,2,3,4,5,6,7}	
legacyCSR			{0,0}	{0,0}	{0,0,0,0}	{0,0,0,0,0,0,0,0}	
CSI reference signal List	_		{0,1}	{0,1}	{0,1,2,3 }	{0,1,2,3,0,1,2,3}	
Number of CSI-I (Nk)	RS ports		{4,4}	{8,8}	{8,8,8,8}	{8,8,8,8,8,8,8,8}	
CSI-RS-Subframe(Config List		{9,9}	{9,9}	{9,9,9,9}	{8,8,8,8,9,9,9,9,9}	
CodeBookSubsetRe ID=0	CodeBookSubsetRestriction with ID=0		0x 0000 00000000 0001	0x 0000 0000 0000 0020 0000 0000 0001	0x 0000 0000 0000 0020 0000 0000 0001	0x 0000 0000 0000 0020 0000 0000 0001	
alternativeCodeBookE r12	nabledFor4TX-		FALSE	N/A	N/A	N/A	
	$ ho_{\scriptscriptstyle A}$	dB	0	0	0	0	
Downlink power	$ ho_{\scriptscriptstyle B}$	dB	0	0	0	0	
allocation	Pc	dB	-3	-6	-6	-6	
	σ	dB	-3	-3	-3	-3	
$N_{oc}^{(j)}$		dB[mW/15kHz]	-98				
Reporting m	ode			PUSC	CH 3-1		
Reporting int	erval	ms			10		
CRI Delay		ms		1	12		
PMI delay		ms			2		
Measurement channel			R.44A-1 TDD	R.44A-2 TDD	R.44A-2 TDD	R.44A-3 TDD	
OCNG Patt				OP.1	TDD		
Rank Number of PDSCH					1		
Scheduled PDS			SF 0,1,3,6,8,9	SF 0,1,3,6,8,9	SF 0,1,3,6,8,9	SF 0,1,6,8,9	
Max number of HARQ					4		
Redundancy versi sequence	e				,2,3}		
ACK/NACK feedb		ble uplink reportin			olexing		

If the UE reports in an available uplink reporting instance at subrame SF#n based on PMI estimation at a downlink Note 1:

Note 3:

SF not later than SF#(n-4), this reported PMI cannot be applied at the eNB downlink before SF#(n+4). PDSCH _RA= 0 dB, PDSCH_RB= 0 dB in order to have the same PDSCH and OCNG power per subcarrier at the Note 2: receiver.

When one CSI-RS resource configured, the configurations according to NZP-CSI-RS-ID 0 are configured. PDCCH DCI format 0 with a trigger for aperiodic CQI shall be transmitted in downlink SF#4 to allow aperiodic Note 4: CRI/CQI/PMI/RI to be transmitted on uplink SF#2.

Table 9.10.1.2-2: Minimum requirement (TDD)

	Test 1-1	Test 1-2	Test 1-3	Test 1-4
	1.2	1.2	1.3	1.35
	40	40	20	10
UE Category	≥2	≥2	≥2	≥2

Note1: According to UE capability configuration list for the maximum number of NZP CSI-RS resource Kmax and the maximum number of total NZP CSI-RS ports N in each K =2,..., Kmax: if UE supports the combination of (K,N) =(8,64), then test 1-4 is applicable; else if UE supports the combination of (K,N) =(4,32), then test 1-3 is applicable; else if UE supports the combination of (K,N) =(2,16), then test 1-2 is applicable; otherwise test 1-1 is applicable.

10 Performance requirement (MBMS)

10.1 FDD (Fixed Reference Channel)

The parameters specified in Table 10.1-1 are valid for all FDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Table 10.1-1: Common Test Parameters (FDD)

Parameter	Unit	Value		
Number of HARQ processes	Processes	None		
Subcarrier spacing	kHz	15 kHz		
Allocated subframes per Radio Frame (Note 1)		6 subframes		
Number of OFDM symbols for PDCCH		2		
Cyclic Prefix		Extended		
Note1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS.				

Note1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS in line with TS 36.331.

10.1.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.1-1 and Table 10.1.1-1 and Annex A.3.8.1, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.1.1-2.

Note 1:

 $P_B = 0$.

Parameter Unit Test 1-4 dB 0 $\rho_{\scriptscriptstyle A}$ Downlink power dΒ 0 (Note 1) $\rho_{\scriptscriptstyle B}$ allocation dB 0 σ N_{ac} at antenna port dBm/15kHz -98

Table 10.1.1-1: Test Parameters for Testing

Table 10.1.1-2: Minimum performance

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Referen	ce value	MBMS
number		Channel	Pattern	condition	Matrix and	BLER	SNR(dB)	UE
					antenna	(%)		Category
1	10 MHz	R.37 FDD	OP.4				4.1	≥1
			FDD					
2	10 MHz	R.38 FDD	OP.4				11.0	≥1
			FDD	MBSFN				
3	10 MHz	R.39 FDD	OP.4	channel	1x2 low	4	20.1	≥2
			FDD	model (Table	1XZ IOW	ı		
	5.0MHz	R.39-1 FDD	OP.4	B.2.6-1)			20.5	1
			FDD					
4	1.4 MHz	R.40 FDD	OP.4				6.6	≥1
			FDD					

10.2 TDD (Fixed Reference Channel)

The parameters specified in Table 10.2-1 are valid for all TDD tests unless otherwise stated. For the requirements defined in this section, the difference between CRS EPRE and the MBSFN RS EPRE should be set to 0 dB as the UE demodulation performance might be different when this condition is not met (e.g. in scenarios where power offsets are present, such as scenarios when reserved cells are present).

Table 10.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value		
Number of HARQ processes	Processes	None		
Subcarrier spacing	kHz	15 kHz		
Allocated subframes per Radio Frame (Note 1)		5 subframes		
Number of OFDM symbols for PDCCH		2		
Cyclic Prefix		Extended		
Note1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.				

10.2.1 Minimum requirement

The receive characteristic of MBMS is determined by the BLER. The requirement is valid for all RRC states for which the UE has capabilities for MBMS.

For the parameters specified in Table 10.2-1 and Table 10.2.1-1 and Annex A.3.8.2, the average downlink SNR shall be below the specified value for the BLER shown in Table 10.2.1-2.

Test 1-4 **Parameter** Unit dB 0 $\rho_{\scriptscriptstyle A}$ Downlink power dB 0 (Note 1) $\rho_{\scriptscriptstyle B}$ allocation dB 0 N_{oc} at antenna port dBm/15kHz -98 Note 1: $P_B = 0$.

Table 10.2.1-1: Test Parameters for Testing

Table 10.2.1-2: Minimum performance

Test	Bandwidth	Reference	OCNG	Propagation	Correlation	Referen	ce value	MBMS
number		Channel	Pattern	condition	Matrix and	BLER	SNR(dB)	UE
					antenna	(%)		Category
1	10 MHz	R.37 TDD	OP.4				3.4	≥1
			TDD					
2	10 MHz	R.38 TDD	OP.4				11.1	≥1
			TDD	MBSFN				
3a	10 MHz	R.39 TDD	OP.4	channel	1x2 low	1	20.1	≥2
			TDD	model (Table	1 XZ 10W	ı		
3b	5MHz	R.39-1 TDD	OP.4	B.2.6-1)			20.5	1
			TDD					
4	1.4 MHz	R.40 TDD	OP.4				5.8	≥1
			TDD					

11 Performance requirement (ProSe Direct Discovery)

This clause contains the performance requirements for the Sidelink physical channels specified for ProSe Direct Discovery.

11.1 General

11.1.1 Applicability of requirements

The requirements in this clause are applicable to UEs that support ProSe Direct Discovery. The test case applicability is in according to table 11.1.1-1 depending on set of supported UE capabilities.

Table 11.1.1-1: ProSe Direct Discovery test applicability

FDD/TDD	Tests / clause	Applicable if UE indicates at least the following capability
	11.2.1	ProSe Direct Discovery without support of disc-SLSS-r12
T	11.2.3	ProSe Direct Discovery with support of discPeriodicSLSS-r13 and
EDD	11.2.3	ProSe Direct Communication
FDD +	11.3.1	ProSe Direct Discovery
ïI T	11.4.1	ProSe Direct Discovery with support of disc-SLSS-r12
ïI T	11.5.1	ProSe Direct Discovery
	11.2.2	ProSe Direct Discovery
TDD	11.3.2	ProSe Direct Discovery
· T	11.5.2	ProSe Direct Discovery

For maximum Sidelink Processes test specified in clause 11.5, the UE is required to only meet the test for the maximum channel bandwidth over the ProSe operating bands supported by the UE. Test case 11.2.3 for 5MHz channel bandwidth is applicable to UEs that support ProSe Direct Communication on Band 31 only.

11.1.2 Reference DRX configuration

Table 11.1.2-1: Reference DRX configuration

Parameter	Value	Comments
onDurationTimer	psf1	
drx-InactivityTimer	psf1	
drx-RetransmissionTimer	psf1	
longDRX-CycleStartOffset	sf2560, 0	
shortDRX	disabled	
NOTE 1: For further information see c	lause 6.3.2 in TS 36.331.	

11.2 Demodulation of PSDCH (single link performance)

The purpose of the requirements in this subclause is to verify the PSDCH demodulation performance with a single active PSDCH link under different operating scenarios and channel conditions.

The active cell(s), when present, are specified in the test parameters specific to the test.

11.2.1 FDD (in-coverage)

The minimum requirements are specified in Table 11.2.1-2 with the test parameters specified in Table 11.2.1-1. The receiver UE under test is associated with Cell 1.

Table 11.2.1-1: Test Parameters

Parameter		Unit	Test 1	
Discovery resource pool configuration			As specified in Table A.7.1.1-1 (Configuration #1-FDD)	
DRX configuration				As specified in Table 11.1.2-1
$N_{\it oc}$ at antenna por	(NOTE 3)		dBm/15kHz	-98
Active cell(s)				Cell 1 (Serving cell)
	Cyclic prefix			Normal
	Cell ID			0
	Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
0 " 1	power	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
Cell 1	allocation	σ	dB	0
	OCNG Pattern	n (NOTE 2)		OP.1 FDD
	Propagation of	hannel		AWGN
	Antenna confi	guration		1x2
	RSRP		dBm/15kHz	-92
Active Sidelink UE(s	s)			Sidelink UE 1
	Sidelink Trans	missions		PSDCH
	PSDCH RB al	location		PRB pairs {2i2i+1}, where i is chosen randomly uniformly from [0,11] in each discovery period.
Cidaliak LIF 1	Time offset (N	OTE 4)	μs	+1
Sidelink UE 1	Frequency off 5)	set (NOTE	Hz	+200
	Propagation C	hannel	1	EPA5
	Antenna confi			1x2 Low

NOTE 1: $P_{B} = 0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: Applicable to both DL channel and ProSe Direct Discovery Subframes on UL.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.2.1-2: Minimum performance

Test num.	t num. Sidelink UE Band-width		Reference channel	Reference value		
				BLER of PSDCH (%)	SNR (dB)	
1	1	5 MHz	D.1 FDD	30	4.6	

TDD (in-coverage) 11.2.2

The minimum requirements are specified in Table 11.2.2-2 with the test parameters specified in Table 11.2.2-1. The receiver UE under test is associated with Cell 1.

Table 11.2.2-1: Test Parameters

Parameter			Unit	Test 1
Discovery resource pool configuration				As specified in Table A.7.1.2-1 (Configuration #1-TDD)
DRX configuration				As specified in Table 11.1.2-1
$N_{\it oc}$ at antenna port ((NOTE 5)		dBm/15kHz	-98
Active cell(s)				Cell 1 (Serving cell)
	Cyclic prefix			Normal
	Uplink downlink configuration (N			0
	Special subframe configuration (NOTE 4)			4
	Cell ID			0
Cell 1	Downlink power allocation	$ ho_{\scriptscriptstyle A}$	dB	0
		$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
		σ	dB	0
	OCNG Pattern NOTE 2			OP.1 TDD
	Propagation channel			AWGN
	Antenna configuration			1x2
	RSRP		dBm/15kHz	-92
Active Sidelink UE(s)				Sidelink UE 1
	Sidelink Transn	nissions		PSDCH
	RB allocation			PRB pairs {2i2i+1}, where i is chosen randomly uniformly from [0,11] in each discovery period.
Sidelink UE 1	Time offset (NC	TE 6)	μs	+1
Sidelifik DE 1	Frequency offset 7)		Hz	+200
	Propagation Ch	annel		EPA5
	Antenna config	uration		1x2 Low

NOTE 1: $P_{\scriptscriptstyle B}=0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs. NOTE 3: As specified in Table 4.2-2 in TS 36.211 [4].

NOTE 4: As specified in Table 4.2-1 in TS 36.211 [4].

NOTE 5: Applicable to both DL subframes and UL subframes configured for ProSe Direct Discovery.

NOTE 6: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 7: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.2.2-2: Minimum performance

Test num.	Sidelink UE	Band-width	Reference channel	Reference value			
				BLER of PSDCH (%)	SNR (dB)		
1	1	5 MHz	D.1 TDD	30	4.6		

11.2.3 FDD (out-of-coverage)

The minimum requirements are specified in Table 11.2.3-2 with the test parameters specified in Table 11.2.3-1. The receiver UE under test is out of network coverage.

Table 11.2.3-1: Test Parameters

P	Parameter	Unit	Test 1
Resource pool configuration			As specified in Table A.7.1.1-4 (Configuration #4-FDD)
DRX configuration			As specified in Table 11.1.2-1
$N_{\it oc}$ at antenna port		dBm/15kHz	-98
Active cell(s)			None
Active Sidelink UE(s)		Sidelink UEs 1, 2
	Sidelink Transmissions		SLSS + PSBCH
	networkControlledSyncTx		ON
	slssid		30
	inCoverage (in MIB-SL)		TRUE
Sidelink UE 1	syncOffsetIndicator		Set same as syncOffsetIndicator1 in Configuration #4-FDD
	Propagation channel		EPA5
	Antenna configuration		1x2 Low
	$\widehat{E}_{\scriptscriptstyle s}$ at antenna port	dBm/15kHz	-82
	Sidelink Transmissions		PSDCH
	PSDCH RB allocation		PRB pairs {2i2i+1}, where i is chosen randomly uniformly from [0,11] (for 5MHz) or [0,24] (for 10MHz) in each discovery period.
Sidelink UE 2	Time offset (Note 1)	μs	+1
	Frequency offset (Note 2)	Hz	+200
	Propagation Channel		EPA5
	Antenna configuration		1x2 Low

NOTE 1: Time offset of Sidelink UE 2 receive signal timing with respect to Sidelink UE 1 receive signal timing at the tested UE.

NOTE 2: Frequency offset of Sidelink UE 2 with respect to Sidelink UE 1 transmit frequency.

Table 11.2.3-2: Minimum performance

Test number	Sidelink UE	Band-width	Reference channel	Reference value		
				BLER of PSDCH (%)	SNR (dB)	
1	1	5 MHz	D.1 FDD	30	4.6	

11.3 Power imbalance performance with two links

The purpose of this test is to check the demodulation performance when receiving PSDCH transmissions from two Sidelink UEs with power imbalance in one subframe.

11.3.1 FDD

The minimum requirements are specified in Table 11.3.1-2 with the test parameters specified in Table 11.3.1-1. The receiver UE under test is associated with Cell 1. The Sidelink UE 1 and 2 are synchronized to Cell 1 and transmit PSDCH on adjacent RBs.

Table 11.3.1-1: Test Parameters

Parameter			Test 1
Discovery resource pool configuration			As specified in Table A.7.1.1-1 (Configuration #1-FDD)
			As specified in Table 11.1.2-1
(NOTE 3)		dBm/15kHz	-98
			Cell 1 (Serving cell)
Cyclic prefix			Normal
Cell ID			0
Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0
allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
	σ	dB	0
OCNG Pattern (NOTE 2)			OP.1 FDD
Propagation channel			AWGN
			1x2
RSRP		dBm/15kHz	-92
			Sidelink UE 1, Sidelink UE 2
Sidelink Transmissions			PSDCH
			PRB pairs {45}
Time offset (NOTE 3)		μs	0
Frequency offset	(NOTE 4)	Hz	0
			AWGN
Antenna configura	ation		1x2 Low
Sidelink Transmis	sions		PSDCH
PSDCH RB alloca	ation		PRB pairs {67}
Time offset (w.r.t.	Cell 1 DL)	μs	0
Frequency offset 1 UL)	(w.r.t. Cell	Hz	0
Propagation Char	nel		AWGN
Antenna configura			1x2 Low
	Ool configuration (NOTE 3) Cyclic prefix Cell ID Downlink power allocation OCNG Pattern (Note that the propagation channed to	cool configuration (NOTE 3) Cyclic prefix Cell ID Downlink power allocation OCNG Pattern (NOTE 2) Propagation channel Antenna configuration RSRP Sidelink Transmissions PSDCH RB allocation Time offset (NOTE 3) Frequency offset (NOTE 4) Propagation Channel Antenna configuration Sidelink Transmissions PSDCH RB allocation Time offset (w.r.t. Cell 1 DL) Frequency offset (w.r.t. Cell 1 UL) Propagation Channel	cool configuration (NOTE 3) Cyclic prefix Cell ID Downlink power allocation $ \begin{array}{cccccccccccccccccccccccccccccccccc$

NOTE 1: $P_B = 0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: Applicable to both DL channel and ProSe Direct Discovery Subframes on UL.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.3.1-2: Minimum performance

Test	Band-	Sidelink	Reference	Reference va	lue			
num.	width	UE	channel	BLER of PSDCH (%)	SNR (dB)			
4	5	1	D.1 FDD	(NOTE 1)	24.3			
1	MHz	2	D.1 FDD	30	6.9			
NOTE	NOTE 1: There is no BLER requirement for Sidelink UE 1.							

11.3.2 TDD

The minimum requirements are specified in Table 11.3.2-2 with the test parameters specified in Table 11.3.2-1. The receiver UE under test is associated with Cell 1. The Sidelink UE 1 and 2 are synchronized to Cell 1 and transmit PSDCH on adjacent RBs.

Table 11.3.2-1: Test Parameters

Parameter			Unit	Test 1
Discovery resource pool configuration				As specified in Table A.7.1.2-1
DRX configuration				(Configuration #1-TDD)
•				As specified in Table 11.1.2-1
$N_{\it oc}$ at antenna port (NOTE 5)		dBm/15kHz	-98
Active cell(s)				Cell 1 (Serving cell)
	Cyclic prefix			Normal
	Uplink downling configuration	(NOTE 3)		0
	Special subfraconfiguration			4
	Cell ID			0
Cell 1	Downlink	$ ho_{\scriptscriptstyle A}$	dB	0
	power	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
	allocation	σ	dB	0
	OCNG Pattern NOTE 2			OP.1 TDD
	Propagation channel			AWGN
	Antenna configuration			1x2
	RSRP		dBm/15kHz	-92
Active Sidelink UE(s)				Sidelink UE 1, Sidelink UE 2
	Sidelink Transmissions			PSDCH
	PSDCH RB allocation			PRB pairs {45}
	Time offset (NOTE 6)		μs	0
Sidelink UE 1	Frequency off 7)	set (NOTE	Hz	0
	Propagation C			AWGN
	Antenna confi	guration		1x2 Low
	Sidelink Trans	smissions		PSDCH
	RB allocation			PRB pairs {67}
	Time offset (N		μs	0
Sidelink UE 2	Prequency offset (NOTE 7) Propagation Channel		Hz	0
				AWGN
l	Antenna confi			1x2 Low
NOTE 1: D = 0			•	

NOTE 1: $P_B = 0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: As specified in Table 4.2-2 in TS 36.211 [4]. NOTE 4: As specified in Table 4.2-1 in TS 36.211 [4].

NOTE 5: Applicable to both DL subframes and UL subframes configured for ProSe Direct Discovery.

NOTE 6: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 7: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.3.2-2: Minimum performance

Test	Band-	Sidelink	Reference	Reference va	lue			
num.	width	UE	channel	BLER of PSDCH (%)	SNR (dB)			
4	5	1	D.1 TDD	(NOTE 1)	24.3			
1	MHz	2	D.1 TDD	30	6.9			
NOTE	NOTE 1: There is no BLER requirement for Sidelink UE 1.							

11.4 Multiple timing reference test

The purpose of this test is to check the demodulation performance when receiving from two Sidelink UEs that follow different timing references and transmitting on different resources (non-overlapping in time).

11.4.1 FDD

The test parameters are specified in Table 11.4.1-1. Sidelink UE 2 and the receiver UE under test are associated with Cell 1. Sidelink UE 1 and 3 are associated with another cell and use a different timing, and UE 1 acts as a synchronization reference. The minimum requirements are specified in Table 11.4.1-2.

Table 11.4.1-1: Test Parameters

Pa	arameter	Unit	Test 1
Discovery resource po	ool configuration		As specified in Table A.7.1.1-2
DRX configuration			(Configuration #2-FDD) As specified in Table 11.1.2-1
N_{ac} at antenna port (NOTE 2)	dDm/45kUz	-98
00	NOTE 3)	dBm/15kHz	
Active cell(s)	Cualia mastin		Cell 1 (Serving cell)
	Cyclic prefix Cell ID		Normal 0
		dB	0
	Downlink ρ_A	dB	0 (NOTE 1)
Cell 1	allocation $\frac{PB}{\sigma}$	dB	0
	OCNG Pattern NOTE 2	42	OP.1 FDD
	Propagation channel		AWGN
	Antenna configuration		1x2
	RSRP	dBm/15kHz	-92
Active Sidelink UE(s)			Sidelink UEs 1, 2, 3
	Sidelink Transmissions		SLSS
	networkControlledSyncTx		ON
	slssid		30
	Time offset (NOTE 4)	μs	3511
Sidelink UE 1	Frequency offset (NOTE 5)	Hz	-100
	Propagation channel		EPA5
	Antenna configuration		1x2 Low
	$\widehat{E}_{\scriptscriptstyle s}$ of SLSS at antenna	dBm/15kHz	-82
	port		DODOLL
	Sidelink Transmissions		PSDCH
	Resource pool used for transmissions		discRxPool(0)
	RB allocation		PRB pairs {2i2i+1}, where i is chosen randomly uniformly from [0,11] in each discovery period.
Sidelink UE 2	Time offset (NOTE 4)	μs	+1
	Frequency offset (NOTE 5)	Hz	+200
	Propagation Channel		EPA5
1	Antenna configuration		1x2 Low
	Sidelink Transmissions		PSDCH
	Resource pool used for transmissions		discRxPool(1)
	RB allocation		PRB pairs {2i2i+1}, where i is chosen randomly uniformly from [0,11] in each discovery period.
Sidelink UE 3	Time offset (NOTE 4)	μs	3511
	Frequency offset (NOTE 5)	Hz	+300
	Propagation Channel		EPA5
	Antenna configuration		1x2 Low

NOTE 1: $P_B = 0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: Applicable to both DL channel and ProSe Direct Discovery Subframes on UL.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.4.1-2: Minimum performance

Test num.	Band-width	Sidelink UE	Reference channel	Reference value	,
				BLER of PSDCH (%)NOTE 1	SNR (dB)
1	5 MHz	2	D.1 FDD	30	4.6
ı	O IVITZ	3	D.1 FDD	30	4.6
NOTE 4. The	DLED is massive	ad affair C DOD Dia		aa) of load time during which th	- 44 LIF

NOTE 1: The BLER is measured after 5 D2D Discovery periods (1600 frames) of lead time during which the test UE detects and synchronizes to Sidelink UE 1 SLSS.

11.5 Maximum Sidelink processes test

The purpose of this test is to verify the maximum number of Sidelink processes supported by the UE as reported using UE capability signalling (*discSupportedProc*).

The UE is required to meet only the test for the maximum channel bandwidth over the ProSe operating bands supported by the UE.

11.5.1 FDD

The test parameters are specified in Table 11.5.1-1. Multiple discovery resource pools are interleaved. Each Sidelink UE transmits in one of the resource pools with 3 retransmissions. The minimum requirements are specified in Table 11.5.1-2.

Table 11.5.1-1: Test Parameters

	Parameter		Unit	Test 1-7
Discovery resource pool configuration			As specified in Table A.7.1.1-3 (Configuration #3-FDD) with parameters BW _{Channel} , NPools = Number of configured resource pools (as specified in Table 11.5.1-2), and N =	
DDV "				discSupportedProc
DRX configura	ation			As specified in Table 11.1.2-1
Active cell(s)	Cyclic profix			Cell 1 (Serving cell) Normal
	Cyclic prefix Cell ID			Normai 0
		0	dB	0
	Downlink power	$\rho_{\scriptscriptstyle A}$	dB	0 (NOTE 1)
	allocation	$\rho_{\scriptscriptstyle B}$		
Cell 1		σ n NOTE 2	dB	0 OP.1 FDD
	OCNG Pattern NOTE 2 Propagation channel			Static propagation condition No external noise sources are applied
	Antenna conf	Antenna configuration		1x2
	RSRP	g	dBm/15kHz	-85
Active Sidelink	(UE(s)			Sidelink UE i, i = 0,, discSupportedProc-1
	Sidelink Transmission	Sidelink Transmissions		PSDCH (D.1 FDD)
	Resource pool index (NOTE 3)			$\left\lfloor rac{i}{N_{{\scriptscriptstyle MAX}}_{{\scriptscriptstyle LSF}}} ight floor$
Sidelink UE i	PSDCH RB a (NOTE 3)	llocation		PRB pairs {2*(i % N _{MAX_SF}), 2*(i % N _{MAX_SF})+1}
	Time offset (N	NOTE 4)	μs	0
	Frequency of (NOTE 4)	fset	Hz	0
	Propagation Channel			Static propagation condition No external noise sources are applied
	Antenna conf	iguration		1x2 Low

NOTE 1: $P_{\scriptscriptstyle B}=0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs..

NOTE 3: N_{MAX_SF} represents the maximum number of Sidelink UEs transmitting in one subframe. N_{MAX_SF} = 12 (5

MHz), 25 (10MHz), 37 (15MHz), 50 (10MHz).

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 11.5.1-2: Minimum performance

Test num.	Bandwidth	discSupportedProc	Number of configured resource pools	\hat{E}_{s} at antenna port (dBm/15kHz)	Reference value for Sidelink UE i=0discSupportedProc- 1 Fraction of maximum throughput (%)
1	5 MHz	50	5	-85	95
2	10 MHz	50	2	-85	95
3	15 MHz	50	2	-85	95
4	20 MHz	50	1	-85	95
5	10 MHz	400	16	-85	95
6	15 MHz	400	11	-85	95
7	20 MHz	400	8	-85	95

11.5.2 TDD

The test parameters are specified in Table 11.5.2-1. Multiple discovery resource pools are interleaved. Each Sidelink UE transmits in one of the resource pools with 3 retransmissions. The minimum requirements are specified in Table 11.5.2-2.

Table 11.5.2-1: Test Parameters

Parameter		Unit	Test 1-7	
Discovery reso	Discovery resource pool configuration			As specified in Table A.7.1.2-2 (Configuration #2-TDD) with parameters BW _{Channel} , NPools = Number of configured resource pools (as specified in Table 11.5.2-2), and N = discSupportedProc
DRX configuration			As specified in Table 11.1.2-1	
Active cell(s)			Cell 1 (Serving cell)	
	Cyclic prefix			Normal
	Uplink downling configuration (3)	(NOTE		0
		Special subframe configuration (NOTE		4
	Cell ID			0
Cell 1	Downlink	$\rho_{\scriptscriptstyle A}$	dB	0
	power	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
	allocation	σ	dB	0
	OCNG Pattern	OCNG Pattern NOTE 2		OP.1 TDD
	Propagation of	Propagation channel		Static propagation condition No external noise sources are applied
	Antenna configuration			1x2
	RSRP		dBm/15kHz	-85
Active Sidelink				Sidelink UE i, i = 0,, discSupportedProc-1
	Sidelink Transmissions	3		PSDCH (D.1 TDD)
	PSDCH Resource pool (NOTE 5)			$\left\lfloor \frac{i}{N_{\mathit{MAX}_\mathit{SF}}} \right\rfloor$
Sidelink UE i	PSDCH RB al (NOTE 5)	location		PRB pairs {2*(i % N _{MAX_SF}),2*(i % N _{MAX_SF})+1}
	Time offset (N	OTE 6)	μs	0
	Frequency off (NOTE 7)	set	Hz	0
	Propagation C			Static propagation condition No external noise sources are applied
	Antenna confi	guration		1x2 Low
NOTE 1: D	0	·	·	·

NOTE 1: $P_{\scriptscriptstyle B}=0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs. NOTE 3: As specified in Table 4.2-2 in TS 36.211 [4].

NOTE 4: As specified in Table 4.2-1 in TS 36.211 [4]. NOTE 5: N_{MAX_SF} represents the maximum number of Sidelink UEs transmitting in one subframe. N_{MAX_SF} = 12 (5) MHz), 25 (10MHz), 37 (15MHz), 50 (10MHz).

NOTE 6: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 7: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

95

95

95

Reference value Number of $\hat{E}_{arepsilon}$ at configured Test **Bandwidth** discSupportedProc antenna Fraction of maximum throughput (%) for resource num. port Sidelink UE i=0...discSupportedProc-1 pools (dBm/15kHz 5 MHz 50 -85 95 2 10 MHz 50 2 -85 95 15 MHz 50 -85 95 4 95 20 MHz 50 1 -85

-85

-85

-85

Table 11.5.2-2: Minimum performance

12 Performance requirement (ProSe Direct Communication)

16

11

8

This clause contains the performance requirements for the Sidelink physical channels specified for ProSe Direct Communication in TS 36.211 [4].

12.1 General

10 MHz

15 MHz

20 MHz

5

6

12.1.1 Applicability of requirements

400

400

400

12.1.1.1 Applicability of requirements for different channel bandwidths

The requirements in this clause are applicable to UEs that support ProSe Direct Communication. Test cases defined for 5MHz channel bandwidth are applicable to UEs that support ProSe Direct Communication on only Band 31.

12.1.1.2 Test coverage for different number of component carriers

For FDD tests specified in 12.8, if corresponding CA tests are tested, the test coverage can be considered fulfilled without executing single carrier tests.

12.1.1.3 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests with active Sidelink in Clause 12 are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.6A.1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined in Table 12.1.1.3-1. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 12.1.1.3-1: Applicability and test rules for CA UE demodulation tests with active Sidelink

Tests	CA capability	CA configuration from	CA Bandwidth
	where the	the selected CA capbility	combination to be
	tests apply	where the tests apply	tested in priority order
CA tests with 2CCs in Clause 12.8	Any one of the supported CA capabilities with largest aggregated CA bandwidth combination	Any one of the supported FDD CA configurations with largest aggregated CA bandwidth combination	Largest aggregated CA bandwidth combination

12.1.2 Reference DRX configuration

Table 12.1.2-1: Reference DRX configuration

Parameter	Value	Comments			
onDurationTimer	psf1				
drx-InactivityTimer	psf1				
drx-RetransmissionTimer	psf1				
longDRX-CycleStartOffset	sf2560, 0				
shortDRX	disabled				
NOTE 1: For further information see clause 6.3.2 in TS 36.331.					

12.2 Demodulation of PSSCH

The purpose of the requirements in this subclause is to verify the PSSCH demodulation performance with a single active PSSCH link.

12.2.1 FDD

The minimum requirements are specified in Table 12.2.1-2 with the test parameters specified in Table 12.2.1-1. This test specifies an out-of-coverge scenario where Sidelink UE 1 is the synchronization reference only and Sidelink UE 2 transmits PSCCH and PSSCH.

Table 12.2.1-1: Test Parameters

Parameter		Unit	Test 1
Communication resource pool			As specified in Table A.7.2.1-1
configuration			(Configuration #1-FDD)
N_{oc} at antenna port (NOTE 1)		dBm/15 kHz	-98
Active cell(s)			None
	Sidelink Transmissions		SLSS + PSBCH
Sidelink UE 1	networkControlledSyn cTx		ON
	slssid		30
	inCoverage (in MIB- SL)		FALSE
	syncOffsetIndicator		Set same as syncOffsetIndicator1 in Configuration #1-FDD
	Propagation channel		EPA5
	Antenna configuration		1x2 Low
	$\widehat{E}_{\scriptscriptstyle s}$ at antenna port	dBm/15 kHz	-85
	Sidelink Transmissions		PSCCH + PSSCH
	PSCCH RMC		5MHz: CC.3 FDD 10 MHz: CC.4 FDD
	PSCCH subframe allocation		As defined by TS 36.213 with $n_{\it PSCCH}$ chosen randomly
	PSCCH RB allocation		(uniformly) in $[0, \lfloor M_{RB}^{PSCCH} - RP / 2 \rfloor L_{PSCCH} - 1]$ every sc-period
	\widehat{E}_s of PSCCH at	dBm/15 kHz	-85
	antenna port PSSCH RMC		As specificied in Table 12.2.1-2
Sidelink UE 2	PSSCH RMC PSSCH subframe allocation		As per time repetition pattern specified in PSCCH
	PSSCH RB allocation		First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213 HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213
	Time offset (NOTE 2)	μs	+1
	Frequency offset (NOTE 3)	Hz	+200
	Propagation Channel		EVA70
	Antenna configuration		1x2 Low

NOTE 1: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.

NOTE 2: Time offset of Sidelink UE 2 receive signal timing with respect to Sidelink UE 1 receive signal timing at the tested UE.

NOTE 3: Frequency offset of Sidelink UE 2 with respect to Sidelink UE 1 transmit frequency.

Table 12.2.1-2: Minimum performance

Test	Sidelink	Band-	PSSCH	Reference value			
num.	UE	width	Reference channel	Fraction of maximum throughput (%) (NOTE 1)	SNR (dB) of PSSCH		
1	2	10 MHz	CD.1 FDD	70	-3.4		
1 2		5 MHz	CD.1 FDD	70	-3.3		
NOTE 2	NOTE 4. The throughput is maccured ofter 40 radio frames of lead time during which the test LE detects						

NOTE 1: The throughput is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1.

12.3 Demodulation of PSCCH

The purpose of the requirements in this subclause is to verify the PSCCH demodulation performance with a single active PSSCH link.

12.3.1 FDD

The minimum requirements are specified in Table 12.3.1-2 with the test parameters specified in Table 12.3.1-1. This test specifies an out-of-coverage scenario where Sidelink UE 1 is the synchronization reference only and Sidelink UE 2 transmits PSCCH and PSSCH.

Table 12.3.1-1: Test Parameters

Parameter		Unit	Test 1
Communication resource pool			As specified in Table A.7.2.1-1
configuration			(Configuration #1-FDD)
$N_{\it oc}$ at antenna port (NOTE 1)		dBm/15 kHz	-98
Active cell(s)			None
riouve con(c)	Sidelink Transmissions		SLSS + PSBCH
	networkControlledSyn cTx		ON
	slssid		30
Sidelink UE 1	inCoverage (in MIB- SL)		FALSE
	syncOffsetIndicator		Set same as syncOffsetIndicator1 in Configuration #1-FDD
	Propagation channel		EPA5
	Antenna configuration		1x2 Low
	$\widehat{E}_{\scriptscriptstyle s}$ at antenna port	dBm/15 kHz	-85
	Sidelink Transmissions		PSCCH + PSSCH
	PSCCH RMC		As specified in Table 12.3.1-2
	PSCCH subframe allocation		As defined by TS 36.213 with n_{PSCCH} chosen randomly
	PSCCH RB allocation		(uniformly) in $[0, \lfloor M_{RB}^{PSCCH} - RP / 2 \rfloor L_{PSCCH} - 1]$ every sc-period
	PSSCH RMC		CD.1 FDD
Sidelink UE 2	PSSCH subframe allocation		As per time repetition pattern specified in PSCCH
Sidelink de 2	PSSCH RB allocation		First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213 HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213
	Time offset (NOTE 2)	μs	+1
	Frequency offset (NOTE 3)	Hz	+200
	Propagation Channel		EVA70
	Antenna configuration		1x2 Low

NOTE 1: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.

NOTE 2: Time offset of Sidelink UE 2 receive signal timing with respect to Sidelink UE 1 receive signal timing at the tested UE.

NOTE 3: Frequency offset of Sidelink UE 2 with respect to Sidelink UE 1 transmit frequency.

Table 12.3.1-2: Minimum performance

Test	Test Sidelink Band- PSCCH Re		PSCCH Reference	Reference value		
num.	UE	JE width channel		Probability of missed PSCCH (%) (NOTE 1)	SNR (dB) of PSCCH	
1	2	10 MHz	CC.4 FDD	1	4.7	
l '		5 MHz	CC.3 FDD	1	4.8	
NOTE 1:	The probabi	lity in moon	red ofter 10 redic from	as of load time during which the test	LIE detecte and	

NOTE 1: The probability is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1.

12.4 Demodulation of PSBCH

The purpose of the requirements in this subclause is to verify the PSBCH demodulation performance with a single active link.

12.4.1 FDD

The minimum requirements are specified in Table 12.4.1-2 with the test parameters specified in Table 12.4.1-1.

Table 12.4.1-1: Test Parameters

	Parameter	Unit	Test 1
Communication res	ource pool configuration		As specified in Table A.7.2.1-1 (Configuration #1-FDD)
$N_{\it oc}$ at antenna por	t	dBm/15kHz	-98
Active cell(s)			None
, ,	Sidelink Transmissions		SLSS + PSBCH (CP.1 FDD)
	networkControlledSyncTx		ON
	slssid		30
Sidelink UE 1	inCoverage (in MIB-SL)		FALSE
Sidelifik UE 1	syncOffsetIndicator		Set same as syncOffsetIndicator1 in Configuration #1-FDD
	Propagation channel		EPA5
	Antenna configuration		1x2 Low

Table 12.4.1-2: Minimum performance

Test	Sidelink	Band-	Reference	Referen	ce value
num.	UE	width	channel	Probability of missed PSBCH (%) (NOTE 1)	SNR (dB)
1	1	10 MHz	PSBCH	1	4.4
'	ı	5 MHz	(CP.1 FDD)		4.4

NOTE 1: The probability is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1.

12.5 Power imbalance performance with two links

The purpose of this test is to check the demodulation performance when receiving PSSCH transmissions from two Sidelink UEs with power imbalance in one subframe.

12.5.1 FDD

The test parameters in Table 12.5.1-1 specifies an in-coverage scenario where Sidelink UE 1 and 2 are synchronized to Cell 1 and transmit PSSCH on adjacent RBs. The minimum requirements are specified in Table 12.5.1-2.

Table 12.5.1-1: Test Parameters

Parameter			Unit	Test 1
Communication resource pool configuration				As specified in Table A.7.2.1-2
	·			(Configuration #2-FDD)
DRX configuration				As specified in Table 12.1.2-1
N_{oc} at antenna port (Note 3)			dBm/15kHz	-98
Active cell(s)	Active cell(s)			Cell 1 (Serving cell)
	Cyclic prefix			Normal
	Cell ID			0
Cell 1	Downlink nower	$ ho_{\scriptscriptstyle A}$	dB	0
	Downlink power allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
		σ	dB	0
	OCNG Pattern (N	ote 2)		OP.1 FDD
	Propagation chan			AWGN
	Antenna configura	ation		1x2
	RSRP		dBm/15kHz	-92
Active Sidelink UE(s	s)			Sidelink UE 1, Sidelink UE 2
	Sidelink Transmis	sions		PSCCH + PSSCH
	PSCCH RMC			5 MHz: CC.1 FDD
				10 MHz: CC.2 FDD
		PSCCH subframe allocation		$n_{PSCCH}=0$ (as defined in TS 36.213)
	PSCCH RB alloca	ntion		PSCCH o (do dominod in 10 do.210)
0:11:1154	\widehat{E}_s of PSCCH at antenna		dBm/15kHz	-85
Sidelink UE 1	PSSCH RMC			As specified in Table 12.5.1-2
	PSSCH subframe	allocation		As per time repetition pattern specified in PSCCH
	PSSCH RB alloca			PRB pairs {4, 5}
	Time offset (NOT		μs	0
	Frequency offset		Ηz	0
	Propagation Char		112	AWGN
	Antenna configuration			1x2
	Sidelink Transmis			PSCCH + PSSCH
				5 MHz: CC.1 FDD
	PSCCH RMC			10 MHz: CC.2 FDD
	PSCCH subframe	allocation		
	PSCCH RB alloca	ation		$n_{\it PSCCH}=2$ (as defined in TS 36.213)
	\widehat{E}_{s} of PSCCH at		dBm/15kHz	-85
Sidelink UE 2	port			
	PSSCH RMC			As specified in Table 12.5.1-2
	PSSCH subframe			As per time repetition pattern specified in PSCCH
	PSSCH RB alloca	ition		PRB pairs {6, 7}
	Time offset (NOT		μs	0
	Frequency offset	(NOTE 5)	Hz	0
	Propagation Char	Propagation Channel		AWGN
	Antenna configuration			1x2

NOTE 1: $P_B = 0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.

NOTE 4: The power of PSCCH is set high to ensure reliable reception of PSCCH.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 12.5.1-2: Minimum performance

Test	Band-	Sidelink	PSSCH Reference	Reference v	alue		
num.	width	UE	channel	Fraction of maximum throughput (%)	SNR (dB) of PSSCH		
1	5 / 10	1	CD.5 FDD	(NOTE 1)	24.35		
'	MHz	2	CD.5 FDD	70	2.4		
NOTE	NOTE 1: There is no throughput requirement for Sidelink UE 1.						

12.6 Multiple timing reference test

The puporse of this test is to check the PSSCH demodulation performance when receiving from two Sidelink UEs that follow different timing references and transmitting on different resources (non-overalapping in time).

12.6.1 FDD

The test parameters are specified in Table 12.6.1-1. Sidelink UE 2 and the receiver UE under test are associated with Cell 1. Sidelink UE 1 and Sidelink UE 3 are associated with another cell and use a different timing, and Sidelink UE 1 acts as a synchronization reference only. The minimum requirements are specified in Table 12.6.1-2.

Table 12.6.1-1: Test Parameters

F	Parameter		Unit	Test 1				
Communication reso	urce pool configura	tion		As specified in Table A.7.2.1-3 (Configuration #3-FDD)				
DRX configuration				As specified in Table 12.1.2-1				
N_{oc} at antenna port ((Note 3)		dBm/15kHz	-98				
Active cell(s)				Cell 1 (Serving cell)				
	Cyclic prefix			Normal				
	Cell ID			0				
	Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0				
	allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)				
Cell 1		σ	dB	0				
	OCNG Pattern NO			OP.1 FDD				
	Propagation chan			AWGN				
	Antenna configuration		ID (45111	1x2				
Active Cidelink LIE(e)	RSRP		dBm/15kHz	-92				
Active Sidelink UE(s)	Sidelink Transmis	sions		Sidelink UE 1, Sidelink UE 2, Sidelink UE 3 SLSS + PSBCH				
	networkControlled			ON				
	slssid	20,11017		30				
	inCoverage (in M	IB-SL)		TRUE				
	<u> </u>	•		Set same as syncOffsetIndicator in Configuration				
Sidelink UE 1	syncOffsetIndicat			#3-FDD				
Oldomik OL 1	Time offset (NOT		ms	+12.51 ms				
	Frequency offset		Hz	-100 Hz				
	Propagation chan			EPA5				
	Antenna configura			1x2 Low				
	$\widehat{E}_{\scriptscriptstyle s}$ at antenna po	ort	dBm/15kHz	-85				
	Sidelink Transmis	ssions		PSCCH + PSSCH				
	Resource pool			commRxPool(0)				
	DOGGLI DIAG			5MHz: CC.1 FDD				
	PSCCH RMC			10 MHz: CC.2 FDD (NOTE 5)				
	DOCOLL subfrage	DSCCH aubframe allegation		As defined by TS 36.213 with n_{PSCCH} chosen				
	PSCCH subframe allocation			randomly (uniformly) in				
	PSCCH RB alloca	ation		$[0, M_{RB}^{PSCCH-RP}/2]L_{PSCCH}-1]$ every sc-period				
				$[0, LM]_{RB}$ /2 L_{PSCCH} -1] every sc-period				
0:4-1:-1-15	$\mid E_{s} \mid$ of PSCCH at	\overline{E}_s of PSCCH at antenna		-85				
Sidelink UE 2	port		dBm/15kHz					
	PSSCH RMC			As specified in Table 12.6.1-2				
	PSSCH subframe	allocation		As per time repetition pattern specified in PSCCH				
				First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213				
	PSSCH RB alloca	ation		HARQ retransmission: As per frequency hopping				
				indicated in PSCCH and specified in TS36.213				
	Time offset (NOT	E 4, 5)		PSCCH: +1μsPSSCH: +1μs – 288Ts				
	Frequency offset		Hz	+200				
	Propagation Char			EVA70				
	Antenna configura			1x2 Low				
	Sidelink Transmis	ssions		PSCCH + PSSCH				
	Resource pool			commRxPool(1) 5MHz: CC.5 FDD				
	PSCCH RMC			10 MHz: CC.6 FDD				
	PSCCH subframe	allocation		As defined by TS 36.213 with $n_{\it PSCCH}$ chosen				
Sidelink UE 3				randomly (uniformly) in				
	PSCCH RB alloca	ation		$[0, M_{RB}^{PSCCH-RP}/2]L_{PSCCH}-1]$ every sc-period				
				[U, [M _{RB} / 2]L _{PSCCH} — I] every sc-period				
	\widehat{E}_{s} of PSCCH at	antenna	dBm/15kHz	-85				
	port		COM TOKEZ	-00				
	PSSCH RMC			As specified in Table 12.6.1-2				
			•	l l				

PSSCH subframe allocation		As per time repetition pattern specified in PSCCH
PSSCH RB allocation		First transmission: Chosen randomly (uniformly) among the allowed RBs as per TS36.213 HARQ retransmission: As per frequency hopping indicated in PSCCH and specified in TS36.213
Time offset (NOTE 5)	ms	+12.509
Frequency offset (NOTE 6)	Hz	+300
Propagation Channel		EVA70
Antenna configuration		1x2 Low

NOTE 1: $P_B = 0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

NOTE 3: Applicable to both DL channel and ProSe Direct Communication Subframes on UL.

NOTE 4: Timing advance indication in PSSCH is set as 18 (= $288T_s$) in this test. PSSCH timing is advanced with respect

to PSCCH timing by the quantity (i.e., PSSCH timing shall be $+1\mu s - 288T_s$ in this test).

NOTE 5: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 6: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 12.6.1-2: Minimum performance

_ Band- Si		Sidelink PSSCH		Reference value				
Test num.	Test num. width UE		Reference channel	Fraction of maximum throughput (%) (NOTE 1)	SNR (dB)			
	10 MHz	2	CD.4 FDD	70	3.0			
1	10 MHZ	3	CD.2 FDD	70	2.8			
l l	E MILI-	2	CD.3 FDD	70	2.9			
	5 MHz	3	CD.2 FDD	70	2.8			

NOTE 1: The throughput is measured after 40 radio frames of lead time during which the test UE detects and synchronizes to Sidelink UE 1.

12.7 Maximum Sidelink processes test

The purpose of this test is to verify the maximum number of Sidelink processes and the maximum number of bits per TTI supported by the UE.

12.7.1 FDD

The test parameters are specified in Table 12.7.1-1. Multiple communication resource pools are interleaved. Each active Sidelink UE transmits in one of the resource pools with 3 retransmissions. The minimum requirements are specified in Table 12.7.1-2.

Table 12.7.1-1: Test Parameters

	Parameter		Unit	Test 1
Communication rea	ourse peel configure	tion		As specified in Table A.7.2.1-4
Communication res	source pool configura	uon		(Configuration #4-FDD)
DRX configuration				As specified in Table 12.1.2-1
Active cell(s)				Cell 1 (Serving cell)
	Cyclic prefix			Normal
	Cell ID			0
	Downlink power	$ ho_{\scriptscriptstyle A}$	dB	0
	allocation	$ ho_{\scriptscriptstyle B}$	dB	0 (NOTE 1)
Cell 1		σ	dB	0
	OCNG Pattern (N	lote 2)		OP.1 FDD
	Propagation chan	Dropogation channel		Static propagation condition
	Propagation channel			No external noise sources are applied
	Antenna configura	ation		1x2
	RSRP		dBm/15kHz	-85
Active Sidelink UE(Sidelink UE i, 0 ≤ i ≤ 15
	Sidelink Transmis	Sidelink Transmissions		PSCCH + PSSCH
	Resource pool	Resource pool		$commRxPool(\left\lfloor rac{i}{8} ight floor)$
	PSCCH RMC			5MHz: CC.1 FDD with I _{TRP} =i%8 (NOTE 3) 10 MHz: CC.2 FDD with I _{TRP} = i%8 (NOTE 3)
Sidelink UE i,	PSCCH subframe	e allocation		As defined by TS 36.213 with $n_{\it PSCCH}={\rm i}$
0 ≤ i ≤ 15	PSCCH RB alloca	ation		
- · · ·	PSSCH RMC			As specified in Table 12.7.1-2
	PSSCH subframe			As per time repetition pattern specified in PSCCH
	PSSCH RB alloca			Fully allocated
	Time offset (NOT		μs	0
	Frequency offset	(NOTE 5)	Hz	0
	Propagation Char	nnel		Static propagation condition No external noise sources are applied
	Antenna configura	ation		1x2 Low
NOTE 1: D = 0				

NOTE 1: $P_B = 0$.

NOTE 2: OCNG is used to fully allocate the available resource blocks to virtual UEs.

 $I_{TRP} = 1$ corresponds to a time repetition pattern of (0,1,0,0,0,0,0,0), etc.

NOTE 4: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 5: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

Table 12.7.1-2: Minimum performance

Test	Bandwidth	PSCCH Reference	$\hat{E}_{\scriptscriptstyle s}$ at	Reference value for Sidelink UE i=015			
num.	Danawiani	channel	antenna port (dBm/15kHz)	Eraction of maximum throughout (9/1)			
4	10 MHz	CD.7 FDD	-85	95			
'	5 MHz	CD.6 FDD	-85	95			

12.8 Sustained downlink data rate with active Sidelink

The purpose of this test is to verify the downlink data rate is not impacted when Sidelink resource are also configured. The test parameters are in Table 12.8.1-1. Cell 1 is the serving cell and UE 1 and UE 2 are transmitters of Prose Direct Communication. The test UE is expected to receive all PDSCH transmissions, and prioritize the transmission of ACK/NACK over the reception of UE 2's PSSCH.

The test cases apply to UE categories and bandwidth combinations with maximum aggregated bandwidth as specified in Table 12.8.1-2. The minimum requirements are specified in Table 12.8.1-3. The TB success rate in the cellular link shall be sustained during at least 300 frames.

Table 12.8.1-1: Test parameters for sustained downlink data rate (FDD 64QAM) with active Sidelink

	Parameter	Unit	Test 1, 2, 3A, 3B, 4A, 6C
Communication roca	urce pool configuration Note 5		As specified in Table A.7.2.1-5
Communication reso	dice poor configuration		(Configuration #5-FDD)
Active cell(s)			Cell 1 (PCell)
Active cell(s)			Cell 2 (SCell) for Test 3B, 4A, 6C
Cell 1	Test parameters		As specified in clause 8.7.1: Table 8.7.1-1 and Test
Cell 1	Test parameters		1, 2, 3A, 3B, 4A, 6C in Table 8.7.1-2
Active Sidelink UE(s)			Sidelink UE 1, Sidelink UE 2
	Sidelink Transmissions		PSCCH + PSSCH
	PSCCH RMC		10 MHz: CC.2 FDD with ITRP=0 (NOTE 1)
Sidelink UE 1	PSCCH subframe allocation		As defined by TS 36.213 with $n_{PSCCH} = 0$
	PSCCH RB allocation		
	PSSCH RMC		10 MHz: CD.7 FDD
	PSSCH subframe allocation		As per time repetition pattern specified in PSCCH
	PSSCH RB allocation		Fully allocated
	Time offset (NOTE 3)	μS	0
	Frequency offset (NOTE 4)	Hz	0
	Propagation Channel		Static propagation condition No external noise sources are applied
	Antenna configuration		1x2 Low
	\widehat{E}_{s} at antenna port	dBm/15kHz	-85
	Sidelink Transmissions		PSCCH (NOTE 2)
	PSCCH RMC		10 MHz: CC.2 FDD with ITRP=1 (NOTE 1)
	PSCCH subframe allocation		As defined by TC 2C 242 with 19
	PSCCH RB allocation		As defined by TS 36.213 with $n_{\it PSCCH}$ = 1
	Time offset (NOTE 3)	แร	0
Sidelink UE 2	Frequency offset (NOTE 4)	Hz	0
	Propagation Channel		Static propagation condition No external noise sources are applied
	Antenna configuration		1x2 Low
	\widehat{E}_{s} at antenna port	dBm/15kHz	-85

NOTE 2: Sidelink UE 2 transmits PSCCH but not PSSCH.

NOTE 3: Time offset of Sidelink UE receive signal with respect to Cell 1 downlink timing at the tested UE.

NOTE 4: Frequency offset of Sidelink UE with respect to Cell 1 uplink frequency.

NOTE 5: Sidelink Communication resources are configured on the primary serving cell.

Table 12.8.1-2: Test cases for sustained data rate

CA	Maximum supported Bandwidth/	Cat. 1	Cat. 2	Cat. 3 Cat. 4 Cat. 6.7		Cat 6.7	Cat 0.10	Cat 11, 12	DL Cat. 15	
config	Bandwidth combination (MHz)	Cat. 1	Cat. 2	Cat. 3	t. 3 Cat. 4 Cat. 6,7	Cat. 6,7	Cat. 9,10	DL Cat. 11,12	DE 641. 15	
Single carrier	10	1	2	3A	3A	3A	3A	ЗА	ЗА	
CA	10+10	-	-	3B	4A	4A	4A	4A	4A	
with 2CCs (Note1)	10+20	-	-	3B	4A	6C	6C	6C	6C	
NOTE 1:	Sidelink operati	on is configu	red on PCC			•	•	•		

Table 12.8.1-3: Minimum requirements (FDD 64QAM) with active Sidelink

Test	Bandwidth (MHz)	Number of bits of a	Measurement	Reference value
		DL-SCH transport	channel	PDSCH TB success rate (%)
		block received within		
		a TTI		
1	10	10296	R.31-1 FDD (NOTE 2)	95
2	10	25456	R.31-2 FDD (NOTE 2)	95
3A	10	36696 (NOTE 1)	R.31-3A FDD (NOTE	85
			2)	
3B	10+10	25456	R.31-2 FDD (NOTE 2)	95
4A	10+10	75376 (NOTE 3)	R.31-4 FDD (NOTE 2)	85
		36696 (NOTE 1) for	R.31-3A FDD for	
6C	10+20	10MHz CC	10MHz CC	85
00	10+20	75376 (NOTE 3) for	R.31-4 FDD for	05
		20MHz CC	20MHz CC	

NOTE 1: 35160 bits for sub-frame 5.

NOTE 2: PDSCH scheduling pattern is changed as per the following bitmap that repeats every 40ms, and applies to all the serving cells.

PDSCH scheduling subframe bitmap = {01110111 11110111 11110111 1111011}.

NOTE 3: 71112 bits for sub-frame 5.

NOTE 1: 35160 bits for sub-frame 5.

NOTE 2: PDSCH scheduling pattern is changed as per the following bitmap that repeats every 40ms, and applies to all the serving cells.

PDSCH scheduling subframe bitmap = {01110111 11110111 11110111 11111110}.

NOTE 3: 71112 bits for sub-frame 5.

Annex A (normative): Measurement channels

A.1 General

The throughput values defined in the measurement channels specified in Annex A, are calculated and are valid per datastream (codeword). For multi-stream (more than one codeword) transmissions, the throughput referenced in the minimum requirements is the sum of throughputs of all datastreams (codewords).

The UE category entry in the definition of the reference measurement channel in Annex A is only informative and reveals the UE categories, which can support the corresponding measurement channel. Whether the measurement channel is used for testing a certain UE category or not is specified in the individual minimum requirements.

A.2 UL reference measurement channels

A.2.1 General

The measurement channels in the following subclauses are defined to derive the requirements in clause 6 (Transmitter Characteristics) and clause 7 (Receiver Characteristics). The measurement channels represent example configurations of physical channels for different data rates.

A.2.1.1 Applicability and common parameters

The UL reference measurement channels comprise assume transmission of PUSCH and Demodulation Reference signals only. The following conditions apply:

- 1 HARQ transmission
- Cyclic Prefix normal
- PUSCH hopping off
- Link adaptation off
- Demodulation Reference signal as per TS 36.211 [4] subclause 5.5.2.1.2.

Where ACK/NACK is transmitted, it is assumed to be multiplexed on PUSCH as per TS 36.212 [5] subclause 5.2.2.6.

- ACK/NACK 1 bit
- ACK/NACK mapping adjacent to Demodulation Reference symbol
- ACK/NACK resources punctured into data
- Max number of resources for ACK/NACK: 4 SC-FDMA symbols per subframe
- No CQI transmitted, no RI transmitted

A.2.1.2 Determination of payload size

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation N_{RR}

- 1. Calculate the number of channel bits $N_{\rm ch}$ that can be transmitted during the first transmission of a given sub-frame.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min |R - (A + 24*(N_{CB} + 1))/N_{ch}|, where N_{CB} = \begin{cases} 0, & \text{if } C = 1\\ C, & \text{if } C > 1 \end{cases}$$

subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of N_{RB} resource blocks.
- b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].
- c) For RMC-s, which at the nominal target coding rate do not cover all the possible UE categories for the given modulation, reduce the target coding rate gradually (within the same modulation), until the maximal possible number of UE categories is covered.
- 3. If there is more than one A that minimises the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.

A.2.1.3 Overview of UL reference measurement channels

In Table A.2.1.3-1 to A.2.1.3-1L are listed the UL reference measurement channels specified in annexes A.2.2 and A.2.3 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.2.2 and A.2.3 as appropriate.

Table A.2.1.3-1: Overview of UL reference measurement channels (FDD, Full RB allocation, QPSK)

Duplex	Table	Name	вw	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD	Table A.2.2.1.1-1		1.4	QPSK	1/3	6	301	≥ 1	
FDD	Table A.2.2.1.1-1		3	QPSK	1/3	15		≥ 1	
FDD	Table A.2.2.1.1-1		5	QPSK	1/3	25		≥ 1	
FDD	Table A.2.2.1.1-1		10	QPSK	1/3	50		≥ 1	
FDD	Table A.2.2.1.1-1		15	QPSK	1/5	75		≥ 1	
FDD	Table A.2.2.1.1-1		20	QPSK	1/6	100		≥ 1	
FDD / HD-FDD	Table A.2.2.1.1-1a		1.4	QPSK	1/3	6		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		3	QPSK	1/5	15		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		5	QPSK	1/8	25		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		10	QPSK	1/10	36		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		15	QPSK	1/10	36		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1a		20	QPSK	1/10	36		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.1-1b		1.4	QPSK	1/3	6		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.1-1b		3	QPSK	1/3	6		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.1-1b		5	QPSK	1/3	6		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.1-1b		10	QPSK	1/3	6		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.1-1b		15	QPSK	1/3	6		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.1-1b		20	QPSK	1/3	6		-	UE UL category M1

Table A.2.1.3-1A: Overview of UL reference measurement channels (FDD, Full RB allocation, 16-QAM)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD	Table A.2.2.1.2-1		1.4	16QAM	3/4	6		≥ 1	
FDD	Table A.2.2.1.2-1		3	16QAM	1/2	15		≥ 1	
FDD	Table A.2.2.1.2-1		5	16QAM	1/3	25		≥ 1	
FDD	Table A.2.2.1.2-1		10	16QAM	3/4	50		≥ 2	
FDD	Table A.2.2.1.2-1		15	16QAM	1/2	75		≥ 2	
FDD	Table A.2.2.1.2-1		20	16QAM	1/3	100		≥ 2	
FDD / HD-FDD	Table A.2.2.1.2-1a		1.4	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		3	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		5	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		10	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		15	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1a		20	16QAM	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.1.2-1b		1.4	16QAM	1/3	5		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.2-1b		3	16QAM	1/3	5		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.2-1b		5	16QAM	1/3	5		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.2-1b		10	16QAM	1/3	5		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.2-1b		15	16QAM	1/3	5		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.1.2-1b		20	16QAM	1/3	5		-	UE UL category M1

Table A.2.1.3-1B: Overview of UL reference measurement channels (FDD, Full RB allocation, 64-QAM)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD	Table A.2.2.1.3-1		1.4	64QAM	3/4	6		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		3	64QAM	3/4	15		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		5	64QAM	3/4	25		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		10	64QAM	3/4	50		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		15	64QAM	3/4	75		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.1.3-1		20	64QAM	3/4	100		5,8	UL category 5, 8, 13, 14

Table A.2.1.3-1C: Overview of UL reference measurement channels (FDD, Partial RB allocation, QPSK)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off	UE Cat	Notes
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	1	set	eg ≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	2		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	3		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	4		≥ 1	
FDD	Table A.2.2.2.1-1		1.4 - 20	QPSK	1/3	5		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	6		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	8		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	9		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	10		≥ 1	
FDD	Table A.2.2.2.1-1		3 - 20	QPSK	1/3	12		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	15		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	16		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	18		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	20		≥ 1	
FDD	Table A.2.2.2.1-1		5 - 20	QPSK	1/3	24		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	25		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	27		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	30		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	32		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	36		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	40		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	45		≥ 1	
FDD	Table A.2.2.2.1-1		10 - 20	QPSK	1/3	48		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/3	50		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/3	54		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	60		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	64		≥ 1	
FDD	Table A.2.2.2.1-1		15 - 20	QPSK	1/4	72		≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	75		≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	80		≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/5	81		≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/6	90		≥ 1	
FDD	Table A.2.2.2.1-1		20	QPSK	1/6	96		≥ 1	
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	1		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	2		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	3		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	4		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		1.4 - 20	QPSK	1/3	5		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/3	6		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/3	8		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/3	9		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/3	10		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		3-20	QPSK	1/4	12		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a		5-20	QPSK	1/5	15		-	UE UL category 0

FDD / HD-FDD	Table A.2.2.2.1-1a	5-20	QPSK	1/5	16	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a	5-20	QPSK	1/6	18	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a	5-20	QPSK	1/6	20	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a	5-20	QPSK	1/8	24	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a	10-20	QPSK	1/8	25	ı	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a	10-20	QPSK	1/8	27		UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1a	10-20	QPSK	1/10	30	-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1-1b	1.4-20	QPSK	1/3	1	i	UE UL category M1
FDD / HD-FDD	Table A.2.2.2.1-1b	1.4-20	QPSK	1/3	2	ı	UE UL category M1
FDD / HD-FDD	Table A.2.2.2.1-1b	1.4-20	QPSK	1/3	3	i	UE UL category M1
FDD / HD-FDD	Table A.2.2.2.1-1b	1.4-20	QPSK	1/3	4	i	UE UL category M1
FDD / HD-FDD	Table A.2.2.2.1-1b	1.4-20	QPSK	1/3	5	-	UE UL category M1
FDD / HD-FDD	Table A.2.2.2.1-1b	3-20	QPSK	1/3	6	-	UE UL category M1

Table A.2.1.3-1D: Overview of UL reference measurement channels (FDD, Partial RB allocation, 16-QAM)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD	Table A.2.2.2.1		1.4 - 20	16QAM	3/4	1		≥ 1	
FDD	Table A.2.2.2.1		1.4 - 20	16QAM	3/4	2		≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	3		≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	4		≥ 1	
FDD	Table A.2.2.2.2-1		1.4 - 20	16QAM	3/4	5		≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	6		≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	8		≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	9		≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	10		≥ 1	
FDD	Table A.2.2.2.2-1		3 - 20	16QAM	3/4	12		≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/2	15		≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/2	16		≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/2	18		≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/3	20		≥ 1	
FDD	Table A.2.2.2.2-1		5 - 20	16QAM	1/3	24		≥ 1	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	1/3	25		≥ 1	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	1/3	27		≥ 1	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	30		≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	32		≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	36		≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	40		≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	45		≥ 2	
FDD	Table A.2.2.2.2-1		10 - 20	16QAM	3/4	48		≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	3/4	50		≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	3/4	54		≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	2/3	60		≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	2/3	64		≥ 2	
FDD	Table A.2.2.2.2-1		15 - 20	16QAM	1/2	72		≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	1/2	75		≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	1/2	80		≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	1/2	81		≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	2/5	90		≥ 2	
FDD	Table A.2.2.2.2-1		20	16QAM	2/5	96		≥ 2	
FDD / HD-FDD	Table A.2.2.2.1a		1.4 - 20	16QAM	3/4	1		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1a		1.4 - 20	16QAM	3/4	2		_	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1a		1.4 - 20	16QAM	2/5	4		-	UE UL category 0
FDD / HD-FDD	Table A.2.2.2.1b		1.4 - 20	16QAM	3/4	1		-	UE UL category M1
FDD / HD-FDD	Table A.2.2.2-1b		1.4 - 20	16QAM	3/4	2			UE UL category M1
FDD / HD-FDD	Table A.2.2.2-1b		1.4 - 20	16QAM	2/5	4		-	UE UL category M1

Table A.2.1.3-1E: Overview of UL reference measurement channels (FDD, Partial RB allocation, 64-QAM)

Duplex	Table						RB	UE	
	Table	Name	BW	Mod	TCR	RB	Off	Cat eg	Notes
FDD 1	Гable A.2.2.2.3-1		1.4 - 20	64QAM	3/4	1		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		1.4 - 20	64QAM	3/4	2		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		1.4 - 20	64QAM	3/4	3		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		1.4 - 20	64QAM	3/4	4		5,8	UL category 5, 8, 13, 14
FDD 1	Table A.2.2.2.3-1		1.4 - 20	64QAM	3/4	5		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	6		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	8		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	9		5,8	UL category 5, 8, 13, 14
FDD 1	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	10		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		3 - 20	64QAM	3/4	12		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		5 - 20	64QAM	3/4	15		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		5 - 20	64QAM	3/4	16		5,8	UL category 5, 8, 13, 14
FDD 1	Table A.2.2.2.3-1		5 - 20	64QAM	3/4	18		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		5 - 20	64QAM	3/4	20		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		5 - 20	64QAM	3/4	24		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	25		5,8	UL category 5, 8, 13, 14
FDD 1	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	27		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	30		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	32		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	36		5,8	UL category 5, 8, 13, 14
FDD 1	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	40		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	45		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		10 - 20	64QAM	3/4	48		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		15 - 20	64QAM	3/4	50		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		15 - 20	64QAM	3/4	54		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		15 - 20	64QAM	3/4	60		5,8	UL category 5, 8, 13, 14
FDD 1	Table A.2.2.2.3-1		15 - 20	64QAM	3/4	64		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		15 - 20	64QAM	3/4	72		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	75		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	80		5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	81		5,8	UL category 5, 8, 13, 14
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	90		5,8	UL category 5, 8, 13,
FDD	Table A.2.2.2.3-1		20	64QAM	3/4	96		5,8	UL category 5, 8, 13,

Table A.2.1.3-1F: Overview of UL reference measurement channels (TDD, Full RB allocation, QPSK)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
TDD	Table A.2.3.1.1-1		1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.2.3.1.1-1		3	QPSK	1/3	15		≥ 1	
TDD	Table A.2.3.1.1-1		5	QPSK	1/3	25		≥ 1	
TDD	Table A.2.3.1.1-1		10	QPSK	1/3	50		≥ 1	
TDD	Table A.2.3.1.1-1		15	QPSK	1/5	75		≥ 1	
TDD	Table A.2.3.1.1-1		20	QPSK	1/6	100		≥ 1	
TDD	Table A.2.3.1.1-1a		1.4	QPSK	1/3	6		-	UE UL category 0
TDD	Table A.2.3.1.1-1a		3	QPSK	1/5	15		-	UE UL category 0
TDD	Table A.2.3.1.1-1a		5	QPSK	1/8	25		-	UE UL category 0
TDD	Table A.2.3.1.1-1a		10	QPSK	1/10	36		-	UE UL category 0
-	Table A.2.3.1.1-1a		15	QPSK	1/10	36		-	UE UL category 0
TDD	Table A.2.3.1.1-1a		20	QPSK	1/10	36		-	UE UL category 0
TDD	Table A.2.3.1.1-1b		1.4	QPSK	1/3	6		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		3	QPSK	1/3	6		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		5	QPSK	1/3	6		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		10	QPSK	1/3	6		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		15	QPSK	1/3	6		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		20	QPSK	1/3	6		-	UE UL category M1

Table A.2.1.3-1G: Overview of UL reference measurement channels (TDD, Full RB allocation, 16-QAM)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
TDD	Table A.2.3.1.2-1		1.4	16QAM	3/4	6		≥ 1	
TDD	Table A.2.3.1.2-1		3	16QAM	1/2	15		≥ 1	
TDD	Table A.2.3.1.2-1		5	16QAM	1/3	25		≥ 1	
TDD	Table A.2.3.1.2-1		10	16QAM	3/4	50		≥ 2	
TDD	Table A.2.3.1.2-1		15	16QAM	1/2	75		≥ 2	
TDD	Table A.2.3.1.2-1		20	16QAM	1/3	100		≥ 2	
TDD	Table A.2.3.1.2-1a		1.4	16QAM	1/3	5		-	UE UL category 0
TDD	Table A.2.3.1.2-1a		3	16QAM	1/3	5		-	UE UL category 0
TDD	Table A.2.3.1.2-1a		5	16QAM	1/3	5		-	UE UL category 0
TDD	Table A.2.3.1.2-1a		10	16QAM	1/3	5		-	UE UL category 0
TDD	Table A.2.3.1.2-1a		15	16QAM	1/3	5		-	UE UL category 0
TDD	Table A.2.3.1.2-1a		20	16QAM	1/3	5		-	UE UL category 0
TDD	Table A.2.3.1.1-1b		1.4	16QAM	1/3	5		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		3	16QAM	1/3	5		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		5	16QAM	1/3	5		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		10	16QAM	1/3	5		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		15	16QAM	1/3	5		-	UE UL category M1
TDD	Table A.2.3.1.1-1b		20	16QAM	1/3	5		-	UE UL category M1

Table A.2.1.3-1H: Overview of UL reference measurement channels (TDD, Full RB allocation, 64-QAM)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
TDD	Table A.2.3.1.3-1		1.4	64QAM	3/4	6		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.1.3-1		3	64QAM	3/4	15		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.1.3-1		5	64QAM	3/4	25		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.1.3-1		10	64QAM	3/4	50		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.1.3-1		15	64QAM	3/4	75		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.1.3-1		20	64QAM	3/4	100		5,8	UL category 5, 8, 13, 14

Table A.2.1.3-1I: Overview of UL reference measurement channels (TDD, Partial RB allocation, QPSK)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	1		≥ 1	
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	2		≥ 1	
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	3		≥ 1	
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	4		≥ 1	
TDD	Table A.2.3.2.1-1		1.4 - 20	QPSK	1/3	5		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	6		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	8		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	9		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	10		≥ 1	
TDD	Table A.2.3.2.1-1		3 - 20	QPSK	1/3	12		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	15		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	16		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	18		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	20		≥ 1	
TDD	Table A.2.3.2.1-1		5 - 20	QPSK	1/3	24		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	25		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	27		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	30		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	32		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	36		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	40		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	45		≥ 1	
TDD	Table A.2.3.2.1-1		10 - 20	QPSK	1/3	48		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/3	50		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/3	54		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	60		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	64		≥ 1	
TDD	Table A.2.3.2.1-1		15 - 20	QPSK	1/4	72		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/5	75		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/5	80		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/5	81		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/6	90		≥ 1	
TDD	Table A.2.3.2.1-1		20	QPSK	1/6	96		≥ 1	
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	1		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	2		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	3		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	4		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		1.4 - 20	QPSK	1/3	5		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/3	6		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/3	8		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/3	9		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/3	10		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		3-20	QPSK	1/4	12		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		5-20	QPSK	1/5	15		-	UE UL category 0
TDD	Table A.2.3.2.1-1a		5-20	QPSK	1/5	16		-	UE UL category 0

TDD	Table A.2.3.2.1-1a	5-20	QPSK	1/6	18	-	UE UL category 0
TDD	Table A.2.3.2.1-1a	5-20	QPSK	1/6	20	-	UE UL category 0
TDD	Table A.2.3.2.1-1a	5-20	QPSK	1/8	24	-	UE UL category 0
TDD	Table A.2.3.2.1-1a	10-20	QPSK	1/8	25	-	UE UL category 0
TDD	Table A.2.3.2.1-1a	10-20	QPSK	1/8	27	-	UE UL category 0
TDD	Table A.2.3.2.1-1a	10-20	QPSK	1/10	30	-	UE UL category 0
TDD	Table A.2.3.2.1-1b	1.4-20	QPSK	1/3	1	-	UE UL category M1
TDD	Table A.2.3.2.1-1b	1.4-20	QPSK	1/3	2	-	UE UL category M1
TDD	Table A.2.3.2.1-1b	1.4-20	QPSK	1/3	3	-	UE UL category M1
TDD	Table A.2.3.2.1-1b	1.4-20	QPSK	1/3	4		UE UL category M1
TDD	Table A.2.3.2.1-1b	1.4-20	QPSK	1/3	5	-	UE UL category M1
TDD	Table A.2.3.2.1-1b	3-20	QPSK	1/3	6	-	UE UL category M1

Table A.2.1.3-1J: Overview of UL reference measurement channels (TDD, Partial RB allocation, 16-QAM)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	1		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	2		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	3		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	4		≥ 1	
TDD	Table A.2.3.2.2-1		1.4 - 20	16QAM	3/4	5		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	6		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	8		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	9		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	10		≥ 1	
TDD	Table A.2.3.2.2-1		3 - 20	16QAM	3/4	12		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/2	15		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/2	16		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/2	18		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/3	20		≥ 1	
TDD	Table A.2.3.2.2-1		5 - 20	16QAM	1/3	24		≥ 1	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	1/3	25		≥ 1	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	1/3	27		≥ 1	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	3/4	30		≥ 2	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	3/4	32		≥ 2	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	3/4	36		≥ 2	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	3/4	40		≥ 2	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	3/4	45		≥ 2	
TDD	Table A.2.3.2.2-1		10 - 20	16QAM	3/4	48		≥ 2	
TDD	Table A.2.3.2.2-1		15 - 20	16QAM	3/4	50		≥ 2	
TDD	Table A.2.3.2.2-1		15 - 20	16QAM	3/4	54		≥ 2	
TDD	Table A.2.3.2.2-1		15 - 20	16QAM	2/3	60		≥ 2	
TDD	Table A.2.3.2.2-1		15 - 20	16QAM	2/3	64		≥ 2	
TDD	Table A.2.3.2.2-1		15 - 20	16QAM	1/2	72		≥ 2	
TDD	Table A.2.3.2.2-1		20	16QAM	1/2	75		≥ 2	
TDD	Table A.2.3.2.2-1		20	16QAM	1/2	80		≥ 2	
TDD	Table A.2.3.2.2-1		20	16QAM	1/2	81		≥ 2	
TDD	Table A.2.3.2.2-1		20	16QAM	2/5	90		≥ 2	
TDD	Table A.2.3.2.2-1		20	16QAM	2/5	96		≥ 2	
TDD	Table A.2.3.2.2-1a		1.4 - 20	16QAM	3/4	1		-	UE UL category 0
TDD	Table A.2.3.2.2-1a		1.4 - 20	16QAM	3/4	2		-	UE UL category 0
TDD	Table A.2.3.2.2-1a		1.4 - 20	16QAM	2/5	4		-	UE UL category 0
TDD	Table A.2.3.2.2-1b		1.4 - 20	16QAM	3/4	1		-	UE UL category M1
TDD	Table A.2.3.2.2-1b		1.4 - 20	16QAM	3/4	2		-	UE UL category M1
TDD	Table A.2.3.2.2-1b		1.4 - 20	16QAM	2/5	4		-	UE UL category M1

Table A.2.1.3-1K: Overview of UL reference measurement channels (TDD, Partial RB allocation, 64-QAM)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off	UE Cat	Notes
TDD	Table A.2.3.2.3-1		1.4 - 20	64QAM	3/4	1	set	eg 5,8	UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1			64QAM				5,8	14 UL category 5, 8, 13,
TDD			1.4 - 20	64QAM	3/4	2		5,8	14 UL category 5, 8, 13,
	Table A.2.3.2.3-1		1.4 - 20		3/4	3			14
TDD	Table A.2.3.2.3-1		1.4 - 20	64QAM	3/4	4		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1		1.4 - 20	64QAM	3/4	5		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1		3 - 20	64QAM	3/4	6		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1		3 - 20	64QAM	3/4	8		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1		3 - 20	64QAM	3/4	9		5,8	UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		3 - 20	64QAM	3/4	10		5,8	UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		3 - 20	64QAM	3/4	12		5,8	UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		5 - 20	64QAM	3/4	15		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		5 - 20	64QAM	3/4	16		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		5 - 20	64QAM	3/4	18		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		5 - 20	64QAM	3/4	20		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		5 - 20	64QAM	3/4	24		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		10 - 20	64QAM	3/4	25		5,8	14 UL category 5, 8, 13,
TDD	Table A 0 2 0 2 4			64QAM	3/4			5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1 Table A.2.3.2.3-1		10 - 20	64QAM	3/4	27		5,8	14 UL category 5, 8, 13,
TDD			10 - 20	64QAM	3/4	30		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1 Table A.2.3.2.3-1		10 - 20		3/4	32		5,8	14 UL category 5, 8, 13,
	Table A.2.3.2.3-1		10 - 20	64QAM	3/4	36			14
TDD	Table A.2.3.2.3-1		10 - 20	64QAM	3/4	40		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1		10 - 20	64QAM	3/4	45		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1		10 - 20	64QAM	3/4	48		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1		15 - 20	64QAM	3/4	50		5,8	UL category 5, 8, 13, 14
TDD	Table A.2.3.2.3-1		15 - 20	64QAM	3/4	54		5,8	UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		15 - 20	64QAM	3/4	60		5,8	UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		15 - 20	64QAM	3/4	64		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		15 - 20	64QAM	3/4	72		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		20	64QAM	3/4	75		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		20	64QAM	3/4	80		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1		20	64QAM	3/4	81		5,8	14 UL category 5, 8, 13,
TDD	Table A.2.3.2.3-1			64QAM	3/4			5,8	14 UL category 5, 8, 13,
TDD			20	64QAM	3/4	90		5,8	14 UL category 5, 8, 13,
	Table A.2.3.2.3-1		20			96		-,0	14

Table A.2.1.3-1L: Overview of UL reference measurement channels (HD-FDD, NB-IoT, QPSK)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
HD-FDD	Table A.2.4-1		0.2	π/2 BPSK	1/3	1		NB1	
HD-FDD	Table A.2.4-1		0.2	π/4 QPSK	1/3	1		NB1	
HD-FDD	Table A.2.4-1		0.2	π/2 BPSK	1/3	1		NB1	
HD-FDD	Table A.2.4-1		0.2	π/4 QPSK	1/3	1		NB1	
HD-FDD	Table A.2.4-1		0.2	QPSK	1/3	1		NB1	
HD-FDD	Table A.2.4-1		0.2	QPSK	1/3	1		NB1	
HD-FDD	Table A.2.4-1		0.2	QPSK	1/3	1		NB1	

A.2.2 Reference measurement channels for FDD

A.2.2.1 Full RB allocation

A.2.2.1.1 QPSK

Table A.2.2.1.1-1 Reference Channels for QPSK with full RB allocation

Parameter	Unit			Va	lue				
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks		6	15	25	50	75	100		
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12		
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK		
Target Coding rate		1/3	1/3	1/3	1/3	1/5	1/6		
Payload size	Bits	600	1544	2216	5160	4392	4584		
Transport block CRC	Bits	24	24	24	24	24	24		
Number of code blocks per Sub-Frame (Note 1)		1	1	1	1	1	1		
Total number of bits per Sub-Frame	Bits	1728	4320	7200	14400	21600	28800		
Total symbols per Sub-Frame		864	2160	3600	7200	10800	14400		
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1		
Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)									

Table A.2.2.1.1-1a Reference Channels for QPSK with full/maximum RB allocation for UE UL category
0

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	36	36	36
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/5	1/8	1/10	1/10	1/10
Payload size	Bits	600	872	904	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame (NOTE 1)		1	1	1	1	1	1
Total number of bits per Sub-Frame	Bits	1728	4320	7200	10368	10368	10368
Total symbols per Sub-Frame		864	2160	3600	5184	5184	5184
UE UL Category		0	0	0	0	0	0

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

Table A.2.2.1.1-1b Reference Channels for QPSK with full/maximum RB allocation for UE UL category M1

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	6	6	6	6	6
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size	Bits	600	600	600	600	600	600
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame (NOTE 1)		1	1	1	1	1	1
Total number of bits per Sub-Frame	Bits	1728	1728	1728	1728	1728	1728
Total symbols per Sub-Frame		864	864	864	864	864	864
UE UL Category		M1	M1	M1	M1	M1	M1

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: For HD-FDD UE with $N_{abs}^{PUSCH}=1$, the uplink subframes are scheduled at the 4th, 5th, and 6th subframes every 10ms for the channel bandwidth 5MHz/10MHz/15MHz/20MHz. For HD-FDD UE, the uplink subframes are scheduled at the 5th, 6th and 7th subframes every 10ms for the channel bandwidth 1.4MHz/3MHz. Information bit payload is available if uplink subframe is scheduled. N_{abs}^{PUSCH} is total number of absolute subframes a PUSCH with repetition spans [4].

NOTE 3: For HD-FDD UE with $N_{abs}^{PUSCH} > 1$, MPDCCH are scheduled at 0th DL subframe every N_{abs}^{PUSCH} +5 subframes (starting from the 0th subframe). The associated PUSCH is scheduled at the 4th to (N_{abs}^{PUSCH} +3)-th UL subframes every N_{abs}^{PUSCH} +5 subframes. Information bit payload is available if uplink subframe is scheduled.

A.2.2.1.2 16-QAM

Table A.2.2.1.2-1: Reference Channels for 16-QAM with full RB allocation

	Value								
MHz	1.4	3	5	10	15	20			
	6	15	25	50	75	100			
	12	12	12	12	12	12			
	16QAM	16QAM	16QAM	16QAM	16QAM	16QAM			
	3/4	1/2	1/3	3/4	1/2	1/3			
Bits	2600	4264	4968	21384	21384	19848			
Bits	24	24	24	24	24	24			
	1	1	1	4	4	4			
Bits	3456	8640	14400	28800	43200	57600			
	864	2160	3600	7200	10800	14400			
	≥ 1	≥ 1	≥ 1	≥ 2	≥2	≥ 2			
	Bits Bits	6 12 16QAM 3/4 Bits 2600 Bits 24 1 Bits 3456 864 ≥ 1	6 15 12 12 16QAM 16QAM 3/4 1/2 Bits 2600 4264 Bits 24 24 1 1 Bits 3456 8640 864 2160 ≥ 1 ≥ 1	6 15 25 12 12 12 16QAM 16QAM 16QAM 3/4 1/2 1/3 Bits 2600 4264 4968 Bits 24 24 24 1 1 1 1 Bits 3456 8640 14400 864 2160 3600 ≥ 1 ≥ 1 ≥ 1	6 15 25 50 12 12 12 12 16QAM 16QAM 16QAM 16QAM 3/4 1/2 1/3 3/4 Bits 2600 4264 4968 21384 Bits 24 24 24 24 1 1 1 4 Bits 3456 8640 14400 28800 864 2160 3600 7200 ≥ 1 ≥ 1 ≥ 1 ≥ 2	6 15 25 50 75 12 12 12 12 12 16QAM 16QAM 16QAM 16QAM 16QAM 3/4 1/2 1/3 3/4 1/2 Bits 2600 4264 4968 21384 21384 Bits 24 24 24 24 24 1 1 1 4 4 Bits 3456 8640 14400 28800 43200 864 2160 3600 7200 10800			

Table A.2.2.1.2-1a: Reference Channels for 16-QAM with maximum RB allocation for UE UL category

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		5	5	5	5	5	5
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size	Bits	872	872	872	872	872	872
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame		1	1	1	1	1	1
Total number of bits per Sub-Frame	Bits	2880	2880	2880	2880	2880	2880
Total symbols per Sub-Frame		720	720	720	720	720	720
UE UL Category		0	0	0	0	0	0

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

Table A.2.2.1.2-1b: Reference Channels for 16-QAM with maximum RB allocation for UE UL category М1

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		5	5	5	5	5	5
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size	Bits	872	872	872	872	872	872
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame		1	1	1	1	1	1
Total number of bits per Sub-Frame	Bits	2880	2880	2880	2880	2880	2880
Total symbols per Sub-Frame		720	720	720	720	720	720
UE Category		M1	M1	M1	M1	M1	M1

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

NOTE 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th and 6th subframes every10ms for the channel bandwidth 5MHz/10MHz/15MHz/20MHz. For HD-FDD UE, the uplink subframes are scheduled at the 5th, 6th, and 7th subframes every 10ms for the channel bandwidth 1.4MHz/3MHz. Information bit payload is available if uplink subframe is scheduled.

A.2.2.1.3 64-QAM

Table A.2.2.1.3-1: Reference Channels for 64-QAM with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding rate		3/4	3/4	3/4	3/4	3/4	3/4
Payload size	Bits	3752	9528	15840	31704	46888	63776
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame (Note 1)		1	2	3	6	8	11
Total number of bits per Sub-Frame	Bits	5184	12960	21600	43200	64800	86400
Total symbols per Sub-Frame		864	2160	3600	7200	10800	14400
UE Category (Note 2)		5,8	5,8	5,8	5,8	5,8	5,8
UE UL Cateogry (Note 2)		5, 8,	5, 8,	5, 8,	5, 8,	5, 8,	5, 8,
		13, 14	13, 14	13, 14	13, 14	13, 14	13, 14

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note2: If UE does not report UE UL category, then the applicability of reference channel is determined by UE category. If UE reports UE UL category, then the applicability of reference channel is determined by UE UL category.

A.2.2.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

A.2.2.2.1 QPSK

Table A.2.2.2.1-1: Reference Channels for QPSK with partial RB allocation

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payload size	Transp ort block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE Category
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	QPSK	1/3	72	24	1	288	144	≥ 1
	1.4 - 20	2	12	QPSK	1/3	176	24	1	576	288	≥ 1
	1.4 - 20	3	12	QPSK	1/3	256	24	1	864	432	≥ 1
	1.4 - 20	4	12	QPSK	1/3	392	24	1	1152	576	≥ 1
	1.4 - 20	5	12	QPSK	1/3	424	24	1	1440	720	≥ 1
	3-20	6	12	QPSK	1/3	600	24	1	1728	864	≥ 1
	3-20	8	12	QPSK	1/3	808	24	1	2304	1152	≥ 1
	3-20	9	12	QPSK	1/3	776	24	1	2592	1296	≥ 1
	3-20	10	12	QPSK	1/3	872	24	1	2880	1440	≥ 1
	3-20	12	12	QPSK	1/3	1224	24	1	3456	1728	≥ 1
	5-20	15	12	QPSK	1/3	1320	24	1	4320	2160	≥ 1
	5-20	16	12	QPSK	1/3	1384	24	1	4608	2304	≥ 1
	5-20	18	12	QPSK	1/3	1864	24	1	5184	2592	≥ 1
	5-20	20	12	QPSK	1/3	1736	24	1	5760	2880	≥ 1
	5-20	24	12	QPSK	1/3	2472	24	1	6912	3456	≥ 1
	10-20	25	12	QPSK	1/3	2216	24	1	7200	3600	≥ 1
	10-20	27	12	QPSK	1/3	2792	24	1	7776	3888	≥ 1
	10-20	30	12	QPSK	1/3	2664	24	1	8640	4320	≥ 1
	10-20	32	12	QPSK	1/3	2792	24	1	9216	4608	≥ 1
	10-20	36	12	QPSK	1/3	3752	24	1	10368	5184	≥ 1
	10-20	40	12	QPSK	1/3	4136	24	1	11520	5760	≥ 1
	10-20	45	12	QPSK	1/3	4008	24	1	12960	6480	≥ 1
	10-20	48	12	QPSK	1/3	4264	24	1	13824	6912	≥ 1
	15 - 20	50	12	QPSK	1/3	5160	24	1	14400	7200	≥ 1
	15 - 20	54	12	QPSK	1/3	4776	24	1	15552	7776	≥ 1
	15 - 20	60	12	QPSK	1/4	4264	24	1	17280	8640	≥ 1
	15 - 20	64	12	QPSK	1/4	4584	24	1	18432	9216	≥ 1
	15 - 20	72	12	QPSK	1/4	5160	24	1	20736	10368	≥ 1
	20	75	12	QPSK	1/5	4392	24	1	21600	10800	≥ 1
	20	80	12	QPSK	1/5	4776	24	1	23040	11520	≥ 1
	20	81	12	QPSK	1/5	4776	24	1	23328	11664	≥ 1
	20	90	12	QPSK	1/6	4008	24	1	25920	12960	≥ 1
	20	96	12	QPSK	1/6	4264	24	1	27648	13824	≥ 1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.2.1-1a: Reference Channels for QPSK with partial RB allocation for UE UL category 0

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbols per Sub- Frame	Mod'n	Target Coding rate	Payload size	Trans- port block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE UL Category
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	QPSK	1/3	72	24	1	288	144	0
	1.4 - 20	2	12	QPSK	1/3	176	24	1	576	288	0
	1.4 - 20	3	12	QPSK	1/3	256	24	1	864	432	0
	1.4 - 20	4	12	QPSK	1/3	392	24	1	1152	576	0
	1.4 - 20	5	12	QPSK	1/3	424	24	1	1440	720	0
	3-20	6	12	QPSK	1/3	600	24	1	1728	864	0
	3-20	8	12	QPSK	1/3	808	24	1	2304	1152	0
	3-20	9	12	QPSK	1/3	776	24	1	2592	1296	0
	3-20	10	12	QPSK	1/3	872	24	1	2880	1440	0
	3-20	12	12	QPSK	1/4	840	24	1	3456	1728	0
	5-20	15	12	QPSK	1/5	872	24	1	4320	2160	0
	5-20	16	12	QPSK	1/5	904	24	1	4608	2304	0
	5-20	18	12	QPSK	1/6	776	24	1	5184	2592	0
	5-20	20	12	QPSK	1/6	872	24	1	5760	2880	0
	5-20	24	12	QPSK	1/8	872	24	1	6912	3456	0
	10-20	25	12	QPSK	1/8	904	24	1	7200	3600	0
	10-20	27	12	QPSK	1/8	968	24	1	7776	3888	0
	10-20	30	12	QPSK	1/10	808	24	1	8640	4320	0

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

Table A.2.2.2.1-1b: Reference Channels for QPSK with partial RB allocation for UE UL category M1

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbols per Sub- Frame	Mod'n	Target Coding rate	Payload size	Trans- port block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE Category
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	QPSK	1/3	72	24	1	288	144	M1
	1.4 - 20	2	12	QPSK	1/3	176	24	1	576	288	M1
	1.4 - 20	3	12	QPSK	1/3	256	24	1	864	432	M1
	1.4 - 20	4	12	QPSK	1/3	392	24	1	1152	576	M1
	1.4 - 20	5	12	QPSK	1/3	424	24	1	1440	720	M1
	3-20	6	12	QPSK	1/3	600	24	1	1728	864	M1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th and 6th subframes every 10ms for the channel bandwidth 5MHz/10MHz/15MHz/20MHz. For HD-FDD UE, the uplink subframes are scheduled at the 5th, 6th, and 7th subframes every 10ms for the channel bandwidth 1.4MHz/3MHz. Information bit payload is available if uplink subframe is scheduled.

A.2.2.2.2 16-QAM

Table A.2.2.2-1 Reference Channels for 16-QAM with partial RB allocation

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbols per Sub- Frame	Mod'n	Target Coding rate	Payload size	Trans- port block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbols per Sub- Frame	UE Category
Unit	MHz					Bits	Bits	,	Bits		
	1.4 - 20	1	12	16QAM	3/4	408	24	1	576	144	≥ 1
	1.4 - 20	2	12	16QAM	3/4	840	24	1	1152	288	≥ 1
	1.4 - 20	3	12	16QAM	3/4	1288	24	1	1728	432	≥ 1
	1.4 - 20	4	12	16QAM	3/4	1736	24	1	2304	576	≥ 1
	1.4 - 20	5	12	16QAM	3/4	2152	24	1	2880	720	≥ 1
	3-20	6	12	16QAM	3/4	2600	24	1	3456	864	≥ 1
	3-20	8	12	16QAM	3/4	3496	24	1	4608	1152	≥ 1
	3-20	9	12	16QAM	3/4	3880	24	1	5184	1296	≥ 1
	3-20	10	12	16QAM	3/4	4264	24	1	5760	1440	≥ 1
	3-20	12	12	16QAM	3/4	5160	24	1	6912	1728	≥ 1
	5-20	15	12	16QAM	1/2	4264	24	1	8640	2160	≥ 1
	5-20	16	12	16QAM	1/2	4584	24	1	9216	2304	≥ 1
	5-20	18	12	16QAM	1/2	5160	24	1	10368	2592	≥ 1
	5-20	20	12	16QAM	1/3	4008	24	1	11520	2880	≥ 1
	5-20	24	12	16QAM	1/3	4776	24	1	13824	3456	≥ 1
	10-20	25	12	16QAM	1/3	4968	24	1	14400	3600	≥ 1
	10-20	27	12	16QAM	1/3	4776	24	1	15552	3888	≥ 1
	10-20	30	12	16QAM	3/4	12960	24	3	17280	4320	≥ 2
	10-20	32	12	16QAM	3/4	13536	24	3	18432	4608	≥ 2
	10-20	36	12	16QAM	3/4	15264	24	3	20736	5184	≥ 2
	10-20	40	12	16QAM	3/4	16992	24	3	23040	5760	≥ 2
	10-20	45	12	16QAM	3/4	19080	24	4	25920	6480	≥ 2
	10-20	48	12	16QAM	3/4	20616	24	4	27648	6912	≥ 2
	15 - 20	50	12	16QAM	3/4	21384	24	4	28800	7200	≥ 2
	15 - 20	54	12	16QAM	3/4	22920	24	4	31104	7776	≥ 2
	15 - 20	60	12	16QAM	2/3	23688	24	4	34560	8640	≥ 2
	15 - 20	64	12	16QAM	2/3	25456	24	4	36864	9216	≥ 2
	15 - 20	72	12	16QAM	1/2	20616	24	4	41472	10368	≥ 2
	20	75	12	16QAM	1/2	21384	24	4	43200	10800	≥ 2
	20	80	12	16QAM	1/2	22920	24	4	46080	11520	≥ 2
	20	81	12	16QAM	1/2	22920	24	4	46656	11664	≥ 2
	20	90	12	16QAM	2/5	20616	24	4	51840	12960	≥ 2
	20	96	12	16QAM	2/5	22152	24	4	55296	13824 Code Block (≥ 2

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.2.1a Reference Channels for 16-QAM with partial RB allocation for UE UL category 0

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payload size	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbol s per Sub- Frame	UE UL Catego ry
Unit	MHz					Bits	Bits		Bits		
•	1.4 - 20	1	12	16QAM	3/4	408	24	1	576	144	0
	1.4 - 20	2	12	16QAM	3/4	840	24	1	1152	288	0
	1.4 - 20	4	12	16QAM	2/5	904	24	1	2304	576	0

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5th, 6th, 12th, 13th, 14th, 20th, 21st, 22nd, 28th, 29th, 30th, 36th, 37th, and 38th subframes every 40ms. Information bit payload is available if uplink subframe is scheduled.

Table A.2.2.2.1b Reference Channels for 16-QAM with partial RB allocation for UE UL category M1

Parame ter	Ch BW	Allocat ed RBs	DFT- OFDM Symbol s per Sub- Frame	M od'n	Target Coding rate	Payload size	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame	Total symbol s per Sub- Frame	UE Catego ry
Unit	MHz					Bits	Bits		Bits		
	1.4 - 20	1	12	16QAM	1/2	256	24	1	576	144	M1
	1.4 - 20	2	12	16QAM	1/2	552	24	1	1152	288	M1
	1.4 - 20	3	12	16QAM	1/2	840	24	1	1728	432	M1
	1.4 - 20	4	12	16QAM	2/5	904	24	1	2304	576	M1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: For HD-FDD UE, the uplink subframes are scheduled at the 4th, 5thand 6th subframes every 10ms for the channel bandwidth 5MHz/10MHz/15MHz/20MHz. For HD-FDD UE, the uplink subframes are scheduled at the 5th, 6th, and 7th subframes every 10ms for the channel bandwidth 1.4MHz/3MHz. Information bit payload is available if uplink subframe is scheduled.

A.2.2.2.3 64-QAM

Table A.2.2.2.3-1: Reference Channels for 64-QAM with partial RB allocation

Param eter	Ch BW	Alloca ted RBs	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Codin g rate	Payloa d size	Trans- port block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total numbe r of bits per Sub- Frame	Total symbol s per Sub- Frame	UE Categor y (Note 2)	UE UL Cateogr y (Note 2)
Unit	MHz					Bits	Bits	(11000 1)	Bits			
	1.4 - 20	1	12	64QAM	3/4	616	24	1	864	144	5,8	5, 8, 13, 14
	1.4 - 20	2	12	64QAM	3/4	1256	24	1	1728	288	5,8	5, 8, 13, 14
	1.4 - 20	3	12	64QAM	3/4	1864	24	1	2592	432	5,8	5, 8, 13, 14
	1.4 - 20	4	12	64QAM	3/4	2536	24	1	3456	576	5,8	5, 8, 13, 14
	1.4 - 20	5	12	64QAM	3/4	3112	24	1	4320	720	5,8	5, 8, 13, 14
	3-20	6	12	64QAM	3/4	3752	24	1	5184	864	5,8	5, 8, 13, 14
	3-20	8	12	64QAM	3/4	5160	24	1	6912	1152	5,8	5, 8, 13, 14
	3-20	9	12	64QAM	3/4	5736	24	1	7776	1296	5,8	5, 8, 13, 14
	3-20	10	12	64QAM	3/4	6200	24	2	8640	1440	5,8	5, 8, 13, 14
	3-20	12	12	64QAM	3/4	7480	24	2	10368	1728	5,8	5, 8, 13, 14
	5-20	15	12	64QAM	3/4	9528	24	2	12960	2160	5,8	5, 8, 13, 14
	5-20	16	12	64QAM	3/4	10296	24	2	13824	2304	5,8	5, 8, 13, 14
	5-20	18	12	64QAM	3/4	11448	24	2	15552	2592	5,8	5, 8, 13, 14
	5-20	20	12	64QAM	3/4	12576	24	3	17280	2880	5,8	5, 8, 13, 14
	5-20	24	12	64QAM	3/4	15264	24	3	20736	3456	5,8	5, 8, 13, 14
	10-20	25	12	64QAM	3/4	15840	24	3	21600	3600	5,8	5, 8, 13, 14
	10-20	27	12	64QAM	3/4	16992	24	3	23328	3888	5,8	5, 8, 13, 14
	10-20	30	12	64QAM	3/4	19080	24	4	25920	4320	5,8	5, 8, 13, 14
	10-20	32	12	64QAM	3/4	20616	24	4	27648	4608	5,8	5, 8, 13, 14
	10-20	36	12	64QAM	3/4	22920	24	4	31104	5184	5,8	5, 8, 13, 14
	10-20	40	12	64QAM	3/4	25456	24	5	34560	5760	5,8	5, 8, 13, 14
	10-20	45	12	64QAM	3/4	28336	24	5	38880	6480	5,8	5, 8, 13, 14
	10-20	48	12	64QAM	3/4	30576	24	5	41472	6912	5,8	5, 8, 13, 14
	15 - 20	50	12	64QAM	3/4	31704	24	6	43200	7200	5,8	5, 8, 13,
	15 - 20	54	12	64QAM	3/4	34008	24	6	46656	7776	5,8	5, 8, 13, 14
	15 - 20	60	12	64QAM	3/4	37888	24	7	51840	8640	5,8	5, 8, 13, 14
	15 - 20	64	12	64QAM	3/4	40576	24	7	55296	9216	5,8	5, 8, 13, 14
	15 - 20	72	12	64QAM	3/4	45352	24	8	62208	10368	5,8	5, 8, 13, 14
	20	75	12	64QAM	3/4	46888	24	8	64800	10800	5,8	5, 8, 13, 14
	20	80	12	64QAM	3/4	51024	24	9	69120	11520	5,8	5, 8, 13, 14

20	81	12	64QAM	3/4	51024	24	9	69984	11664	5,8	5, 8, 13, 14
20	90	12	64QAM	2/3	51024	24	9	77760	12960	5,8	5, 8, 13, 14
20	96	12	64QAM	3/4	61664	24	11	82944	13824	5,8	5, 8, 13, 14

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code

Block (otherwise L = 0 Bit)

Note2: If UE does not report UE UL category, then the applicability of reference channel is determined by UE category. If

UE reports UE UL category, then the applicability of reference channel is determined by UE UL category

A.2.2.3 Void

Table A.2.2.3-1: Void

A.2.3 Reference measurement channels for TDD

For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL:2UL.

A.2.3.1 Full RB allocation

A.2.3.1.1 QPSK

Table A.2.3.1.1-1 Reference Channels for QPSK with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/3	1/3	1/3	1/5	1/6
Payload size							
For Sub-Frame 2,3,7,8	Bits	600	1544	2216	5160	4392	4584
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame							
(Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	1	1	1
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	1728	4320	7200	14400	21600	28800
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8		864	2160	3600	7200	10800	14400
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.1.1-1a Reference Channels for QPSK with full/maximum RB allocation for UE UL category 0

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	36	36	36
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/5	1/8	1/10	1/10	1/10
Payload size							
For Sub-Frame 2,3,7,8	Bits	600	872	904	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame							
(Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	1	1	1
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	1728	4320	7200	10368	10368	10368
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8		864	2160	3600	5184	5184	5184
UE UL Category		0	0	0	0	0	0

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: As per Table 4.2-2 in TS 36.211

Table A.2.3.1.1-1b Reference Channels for QPSK with full/maximum RB allocation for UE UL category

M1

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	6	6	6	6	6
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size							
For Sub-Frame 2,3,7,8	Bits	600	600	600	600	600	600
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame (Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	1	1	1
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	1728	1728	1728	1728	1728	1728
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8		864	864	864	864	864	864
UE UL Category		M1	M1	M1	M1	M1	M1

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: As per Table 4.2-2 in TS 36.211

A.2.3.1.2 16-QAM

Table A.2.3.1.2-1: Reference Channels for 16-QAM with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding rate		3/4	1/2	1/3	3/4	1/2	1/3
Payload size							
For Sub-Frame 2,3,7,8	Bits	2600	4264	4968	21384	21384	19848
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame (Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	4	4	4
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	3456	8640	14400	28800	43200	57600
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8		864	2160	3600	7200	10800	14400
UE Category		≥ 1	≥ 1	≥ 1	≥ 2	≥ 2	≥ 2

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.1.2-1a: Reference Channels for 16-QAM with maximum RB allocation for UE UL category

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		5	5	5	5	5	5
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size							
For Sub-Frame 2,3,7,8	Bits	872	872	872	872	872	872
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame							
(Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	1	1	1
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	2880	2880	2880	2880	2880	2880
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8		720	720	720	720	720	720
UE UL Category		0	0	0	0	0	0

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: As per Table 4.2-2 in TS 36.211[4]

Table A.2.3.1.2-1b: Reference Channels for 16-QAM with maximum RB allocation for UE UL category M1

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		5	5	5	5	5	5
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Payload size							
For Sub-Frame 2,3,7,8	Bits	872	872	872	872	872	872
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame							
(Note 1)							
For Sub-Frame 2,3,7,8		1	1	1	1	1	1
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	2880	2880	2880	2880	2880	2880
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8		720	720	720	720	720	720
UE Category		M1	M1	M1	M1	M1	M1

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: As per Table 4.2-2 in TS 36.211[4]

A.2.3.1.3 64-QAM

Table A.2.3.1.3-1: Reference Channels for 64-QAM with full RB allocation

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Uplink-Downlink Configuration (Note 2)		1	1	1	1	1	1
DFT-OFDM Symbols per Sub-Frame		12	12	12	12	12	12
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding rate		3/4	3/4	3/4	3/4	3/4	3/4
Payload size							
For Sub-Frame 2,3,7,8	Bits	3752	9528	15840	31704	46888	63776
Transport block CRC	Bits	24	24	24	24	24	24
Number of code blocks per Sub-Frame (Note 1)							
For Sub-Frame 2,3,7,8		1	2	3	6	8	11
Total number of bits per Sub-Frame							
For Sub-Frame 2,3,7,8	Bits	5184	12960	21600	43200	64800	86400
Total symbols per Sub-Frame							
For Sub-Frame 2,3,7,8		864	2160	3600	7200	10800	14400
UE Category (Note 3)		5, 8	5, 8	5, 8	5, 8	5, 8	5, 8
UE UL Cateogry (Note 3)	_	5, 8, 13, 14	5, 8, 13, 14	5, 8, 13, 14	5, 8, 13, 14	5, 8, 13, 14	5, 8, 13, 14

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Note 3: If UE does not report UE UL category, then the applicability of reference channel is determined by UE category. If UE reports UE UL category, then the applicability of reference channel is determined by UE UL category.

A.2.3.2 Partial RB allocation

For each channel bandwidth, various partial RB allocations are specified. The number of allocated RBs is chosen according to values specified in the Tx and Rx requirements. The single allocated RB case is included.

The allocated RBs are contiguous and start from one end of the channel bandwidth. A single allocated RB is at one end of the channel bandwidth.

A.2.3.2.1 **QPSK**

Table A.2.3.2.1-1: Reference Channels for QPSK with partial RB allocation

Parame ter	Ch BW	Allocat ed RBs	UDL Configu ration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Categor y
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	QPSK	1/3	72	24	1	288	144	≥ 1
	1.4 - 20	2	1	12	QPSK	1/3	176	24	1	576	288	≥ 1
	1.4 - 20	3	1	12	QPSK	1/3	256	24	1	864	432	≥ 1
	1.4 - 20	4	1	12	QPSK	1/3	392	24	1	1152	576	≥ 1
	1.4 - 20	5	1	12	QPSK	1/3	424	24	1	1440	720	≥ 1
	3-20	6	1	12	QPSK	1/3	600	24	1	1728	864	≥ 1
	3-20	8	1	12	QPSK	1/3	808	24	1	2304	1152	≥ 1
	3-20	9	1	12	QPSK	1/3	776	24	1	2592	1296	≥ 1
	3-20	10	1	12	QPSK	1/3	872	24	11	2880	1440	≥ 1
	3-20	12	1	12	QPSK	1/3	1224	24	1	3456	1728	≥ 1
	5-20	15	1	12	QPSK	1/3	1320	24	1	4320	2160	≥ 1
	5-20	16	1	12	QPSK	1/3	1384	24	1	4608	2304	≥1
	5-20	18	1	12	QPSK	1/3	1864	24	1	5184	2592	≥ 1
	5-20	20	1	12 12	QPSK	1/3	1736	24	1	5760	2880	≥ 1
	5-20 10-20	24 25	1	12	QPSK QPSK	1/3 1/3	2472	24	1	6912 7200	3456 3600	≥ 1
	10-20	27	1	12	QPSK	1/3	2216 2792	24 24	1	7776	3888	≥ 1 ≥ 1
	10-20	30	1	12	QPSK	1/3	2664	24	1	8640	4320	≥ 1
	10-20	32	1	12	QPSK	1/3	2792	24	1	9216	4608	≥ 1
	10-20	36	1	12	QPSK	1/3	3752	24	1	10368	5184	≥ 1
	10-20	40	1	12	QPSK	1/3	4136	24	1	11520	5760	≥ 1
	10-20	45	1	12	QPSK	1/3	4008	24	1	12960	6480	≥ 1
	10-20	48	1	12	QPSK	1/3	4264	24	1	13824	6912	≥ 1
	15 - 20	50	1	12	QPSK	1/3	5160	24	1	14400	7200	≥ 1
	15 - 20	54	1	12	QPSK	1/3	4776	24	1	15552	7776	≥ 1
	15 - 20	60	1	12	QPSK	1/4	4264	24	1	17280	8640	≥ 1
	15 - 20	64	1	12	QPSK	1/4	4584	24	1	18432	9216	≥ 1
	15 - 20	72	1	12	QPSK	1/4	5160	24	1	20736	10368	≥ 1
	20	75	1	12	QPSK	1/5	4392	24	1	21600	10800	≥ 1
	20	80	1	12	QPSK	1/5	4776	24	1	23040	11520	≥ 1
	20	81	1	12	QPSK	1/5	4776	24	1	23328	11664	≥ 1
	20	90	1	12	QPSK	1/6	4008	24	1	25920	12960	≥ 1
Note 4:	20	96	1	12	QPSK	1/6	4264	24	1	27648	13824	≥ 1

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block Note 1:

(otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.2.1-1a: Reference Channels for QPSK with partial RB allocation for UE UL category 0

Parame ter	Ch BW	Allocat ed RBs	UDL Config uration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE UL Catego ry
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	QPSK	1/3	72	24	1	288	144	0
	1.4 - 20	2	1	12	QPSK	1/3	176	24	1	576	288	0
	1.4 - 20	3	1	12	QPSK	1/3	256	24	1	864	432	0
	1.4 - 20	4	1	12	QPSK	1/3	392	24	1	1152	576	0
	1.4 - 20	5	1	12	QPSK	1/3	424	24	1	1440	720	0
	3-20	6	1	12	QPSK	1/3	600	24	1	1728	864	0
	3-20	8	1	12	QPSK	1/3	808	24	1	2304	1152	0
	3-20	9	1	12	QPSK	1/3	776	24	1	2592	1296	0
	3-20	10	1	12	QPSK	1/3	872	24	1	2880	1440	0
	3-20	12	1	12	QPSK	1/4	840	24	1	3456	1728	0
	5-20	15	1	12	QPSK	1/5	872	24	1	4320	2160	0
	5-20	16	1	12	QPSK	1/5	904	24	1	4608	2304	0
	5-20	18	1	12	QPSK	1/6	776	24	1	5184	2592	0
	5-20	20	1	12	QPSK	1/6	872	24	1	5760	2880	0
	5-20	24	1	12	QPSK	1/8	872	24	1	6912	3456	0
	10-20	25	1	12	QPSK	1/8	904	24	1	7200	3600	0
	10-20	27	1	12	QPSK	1/8	968	24	1	7776	3888	0
	10-20	30	1	12	QPSK	1/10	808	24	1	8640	4320	0

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.2.1-1b: Reference Channels for QPSK with partial RB allocation for UE UL category M1

Parame ter	Ch BW	Allocat ed RBs	UDL Config uration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Catego ry
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	QPSK	1/3	72	24	1	288	144	M1
	1.4 - 20	2	1	12	QPSK	1/3	176	24	1	576	288	M1
	1.4 - 20	3	1	12	QPSK	1/3	256	24	1	864	432	M1
	1.4 - 20	4	1	12	QPSK	1/3	392	24	1	1152	576	M1
	1.4 - 20	5	1	12	QPSK	1/3	424	24	1	1440	720	M1
	3-20	6	1	12	QPSK	1/3	600	24	1	1728	864	M1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 2: As per Table 4.2-2 in TS 36.211 [4].

A.2.3.2.2 16-QAM

Table A.2.3.2.2-1: Reference Channels for 16QAM with partial RB allocation

Parame ter	Ch BW	Allocat ed RBs	UDL Configu ration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Number of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Categor y
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	16QAM	3/4	408	24	1	576	144	≥ 1
	1.4 - 20	2	1	12	16QAM	3/4	840	24	1	1152	288	≥ 1
	1.4 - 20	3	1	12	16QAM	3/4	1288	24	1	1728	432	≥ 1
	1.4 - 20	4	1	12	16QAM	3/4	1736	24	1	2304	576	≥ 1
	1.4 - 20	5	1	12	16QAM	3/4	2152	24	1	2880	720	≥ 1
	3-20	6	1	12	16QAM	3/4	2600	24	1	3456	864	≥ 1
	3-20	8	1	12	16QAM	3/4	3496	24	1	4608	1152	≥ 1
	3-20	9	1	12	16QAM	3/4	3880	24	1	5184	1296	≥ 1
	3-20	10	1	12	16QAM	3/4	4264	24	1	5760	1440	≥ 1
	3-20	12	1	12	16QAM	3/4	5160	24	1	6912	1728	≥ 1
	5-20	15	1	12	16QAM	1/2	4264	24	1	8640	2160	≥ 1
	5-20	16	1	12	16QAM	1/2	4584	24	1	9216	2304	≥ 1
	5-20	18	1	12	16QAM	1/2	5160	24	1	10368	2592	≥ 1
	5-20	20	1	12	16QAM	1/3	4008	24	1	11520	2880	≥ 1
	5-20	24	1	12	16QAM	1/3	4776	24	1	13824	3456	≥ 1
	10-20	25	1	12	16QAM	1/3	4968	24	1	14400	3600	≥ 1
	10-20	27	1	12	16QAM	1/3	4776	24	1	15552	3888	≥ 1
	10-20	30	1	12	16QAM	3/4	12960	24	3	17280	4320	≥ 2
	10-20	32	1	12	16QAM	3/4	13536	24	3	18432	4608	≥ 2
	10-20	36	1	12	16QAM	3/4	15264	24	3	20736	5184	≥ 2
	10-20	40	1	12	16QAM	3/4	16992	24	3	23040	5760	≥ 2
	10-20	45	1	12	16QAM	3/4	19080	24	4	25920	6480	≥ 2
	10-20	48	1	12	16QAM	3/4	20616	24	4	27648	6912	≥ 2
	15 - 20	50	1	12	16QAM	3/4	21384	24	4	28800	7200	≥ 2
	15 - 20	54	1	12	16QAM	3/4	22920	24	4	31104	7776	≥ 2
	15 - 20	60	1	12	16QAM	2/3	23688	24	4	34560	8640	≥ 2
	15 - 20	64	1	12	16QAM	2/3	25456	24	4	36864	9216	≥ 2
	15 - 20	72	1	12	16QAM	1/2	20616	24	4	41472	10368	≥ 2
	20	75	1	12	16QAM	1/2	21384	24	4	43200	10800	≥ 2
	20	80	1	12	16QAM	1/2	22920	24	4	46080	11520	≥ 2
	20	81	1	12	16QAM	1/2	22920	24	4	46656	11664	≥ 2
	20	90	1	12	16QAM	2/5	20616	24	4	51840	12960	≥ 2
	20	96		12	16QAM	2/5	22152	24		55296	13824	

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)
Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.2.2-1a: Reference Channels for 16QAM with partial RB allocation UE UL category 0

Parame ter	Ch BW	Allocat ed RBs	UDL Config uration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE UL Catego ry
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	16QAM	3/4	408	24	1	576	144	0
	1.4 - 20	2		12	16QAM	3/4	840	24	1	1152	288	0
	1.4 - 20	4		12	16QAM	2/5	904	24	1	2304	576	0

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4]

Table A.2.3.2.2-1b: Reference Channels for 16QAM with partial RB allocation UE UL category M1

Parame ter	Ch BW	Allocat ed RBs	UDL Config uration (Note 2)	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Coding rate	Payloa d size for Sub- Frame 2, 3, 7, 8	Transp ort block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total number of bits per Sub- Frame for Sub- Frame 2, 3, 7, 8	Total symbol s per Sub- Frame for Sub- Frame 2, 3, 7, 8	UE Catego ry
Unit	MHz						Bits	Bits		Bits		
	1.4 - 20	1	1	12	16QAM	1/2	256	24	1	576	144	M1
	1.4 - 20	2		12	16QAM	1/2	552	24	1	1152	288	M1
	1.4 - 20	3	1	12	16QAM	1/2	840	24	1	1728	432	M1
	1.4 - 20	4		12	16QAM	2/5	904	24	1	2304	576	M1

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 2: As per Table 4.2-2 in TS 36.211 [4].

A.2.3.2.3 64-QAM

Table A.2.3.2.3-1: Reference Channels for 64-QAM with partial RB allocation

Param eter	Ch BW	Alloca ted RBs	DFT- OFDM Symbol s per Sub- Frame	Mod'n	Target Codin g rate	Payloa d size	Trans- port block CRC	Numbe r of code blocks per Sub- Frame (Note 1)	Total numbe r of bits per Sub- Frame	Total symbol s per Sub- Frame	UE Categor y (Note 3)	UE UL Cateogr y (Note 3)
Unit	MHz					Bits	Bits	, ,	Bits			
	1.4 - 20	1	12	64QAM	3/4	616	24	1	864	144	5,8	5, 8, 13, 14
	1.4 - 20	2	12	64QAM	3/4	1256	24	1	1728	288	5,8	5, 8, 13, 14
	1.4 - 20	3	12	64QAM	3/4	1864	24	1	2592	432	5,8	5, 8, 13, 14
	1.4 - 20	4	12	64QAM	3/4	2536	24	1	3456	576	5,8	5, 8, 13, 14
	1.4 - 20	5	12	64QAM	3/4	3112	24	1	4320	720	5,8	5, 8, 13, 14
	3-20	6	12	64QAM	3/4	3752	24	1	5184	864	5,8	5, 8, 13, 14
	3-20	8	12	64QAM	3/4	5160	24	1	6912	1152	5,8	5, 8, 13, 14
	3-20	9	12	64QAM	3/4	5736	24	1	7776	1296	5,8	5, 8, 13, 14
	3-20	10	12	64QAM	3/4	6200	24	2	8640	1440	5,8	5, 8, 13, 14
	3-20	12	12	64QAM	3/4	7480	24	2	10368	1728	5,8	5, 8, 13, 14
	5-20	15	12	64QAM	3/4	9528	24	2	12960	2160	5,8	5, 8, 13, 14
	5-20	16	12	64QAM	3/4	10296	24	2	13824	2304	5,8	5, 8, 13, 14
	5-20	18	12	64QAM	3/4	11448	24	2	15552	2592	5,8	5, 8, 13, 14
	5-20	20	12	64QAM	3/4	12576	24	3	17280	2880	5,8	5, 8, 13, 14
	5-20	24	12	64QAM	3/4	15264	24	3	20736	3456	5,8	5, 8, 13, 14
	10-20	25	12	64QAM	3/4	15840	24	3	21600	3600	5,8	5, 8, 13, 14
	10-20	27	12	64QAM	3/4	16992	24	3	23328	3888	5,8	5, 8, 13, 14
	10-20	30	12	64QAM	3/4	19080	24	4	25920	4320	5,8	5, 8, 13, 14
	10-20	32	12	64QAM	3/4	20616	24	4	27648	4608	5,8	5, 8, 13, 14
	10-20	36	12	64QAM	3/4	22920	24	4	31104	5184	5,8	5, 8, 13, 14
	10-20	40	12	64QAM	3/4	25456	24	5	34560	5760	5,8	5, 8, 13, 14
	10-20	45	12	64QAM	3/4	28336	24	5	38880	6480	5,8	5, 8, 13, 14
	10-20	48	12	64QAM	3/4	30576	24	5	41472	6912	5,8	5, 8, 13, 14
	15 - 20	50	12	64QAM	3/4	31704	24	6	43200	7200	5,8	5, 8, 13,
	15 - 20	54	12	64QAM	3/4	34008	24	6	46656	7776	5,8	5, 8, 13, 14
	15 - 20	60	12	64QAM	3/4	37888	24	7	51840	8640	5,8	5, 8, 13, 14
	15 - 20	64	12	64QAM	3/4	40576	24	7	55296	9216	5,8	5, 8, 13, 14
	15 - 20	72	12	64QAM	3/4	45352	24	8	62208	10368	5,8	5, 8, 13, 14
	20	75	12	64QAM	3/4	46888	24	8	64800	10800	5,8	5, 8, 13, 14
	20	80	12	64QAM	3/4	51024	24	9	69120	11520	5,8	5, 8, 13, 14

20	81	12	64QAM	3/4	51024	24	9	69984	11664	5,8	5, 8, 13, 14
20	90	12	64QAM	3/4	51024	24	9	77760	12960	5,8	5, 8, 13, 14
20	96	12	64QAM	3/4	61664	24	11	82944	13824	5,8	5, 8, 13, 14

Note 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code

Block (otherwise L = 0 Bit)

Note 2: As per Table 4.2-2 in TS 36.211 [4].

Note 3: If UE does not report UE UL category, then the applicability of reference channel is determined by UE category. If

UE reports UE UL category, then the applicability of reference channel is determined by UE UL category

A.2.3.3 Void

Table A.2.3.3-1: Void

A.2.4 Reference measurement channels for UE category NB1

Table A.2.4-1 Reference Channels for UE category NB1

Parameter				Value			
Sub-carrier spacing (kHz)	3.75	3.75	15	15	15	15	15
Number of tone	1	1	1	1	3	6	12
Modulation	π/2 BPSK	π/4 QPSK	π/2 BPSK	π/4 QPSK	QPSK	QPSK	QPSK
Number of NPUSCH repetition	1	1	1	1	1	1	1
IMCS / ITBS	0/0	3/3	0/0	3/3	5/5	5/5	5/5
Payload size (bits)	32	40	32	40	72	72	72
Allocated resource unit	2	1	2	1	1	1	1
Code rate (target)	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Code rate (effective)	0.29	0.33	0.29	0.33	0.33	0.33	0.33
Transport block CRC (bits)	24	24	24	24	24	24	24
Code block CRC size (bits)	0	0	0	0	0	0	0
Number of code blocks – C	1	1	1	1	1	1	1
Total number of bits per resource unit	96	192	96	192	288	288	288
Total symbols per resource unit	96	96	96	96	144	144	144
Tx time (ms)	64	32	16	8	4	2	1

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

NOTE 2: Parameters related to NPUSCH format 1 scheduling are defined in Table A.2.4-2.

NOTE 3: NPDCCH is not transmitted in the subframes used for transmission of SI messages.

NOTE 4: SI messages transmission should be prioritized over NPDCCH transmission in case of collision. NPDCCH transmission is postponed until the next NB-IoT downlink subframe in case NPDCCH transmission occurs in a non NB-IoT downlink subframe, where an NB-IoT downlink subframe is a subframe that does not contain NPSS/NSSS/NPBCH/SIB1-NB transmission.

Parameter	Unit	Value
DCI format		DCI format N0
NPDCCH format		1
Scheduling delay ($I_{ m Delay}$)		0
DCI subframe repetition number		00
$R_{ m max}$ (npdcch-NumRepetitions)		1
G (NPDCCH-startSF-USS)		8
$lpha_{ m offset}$ (npdcch-Offset-USS)		1/4

Table A.2.4-2: NPDCCH configuration for NPUSCH format 1 scheduling

A.3 DL reference measurement channels

A.3.1 General

The number of available channel bits varies across the sub-frames due to PBCH and PSS/SSS overhead. The payload size per sub-frame is varied in order to keep the code rate constant throughout a frame.

Unless otherwise stated, no user data is scheduled on subframes #5 in order to facilitate the transmission of system information blocks (SIB).

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation N_{RB}

- 1. Calculate the number of channel bits N_{ch} that can be transmitted during the first transmission of a given sub-frame.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min |R - (A + 24*(N_{CB} + 1))/N_{ch}|, where N_{CB} = \begin{cases} 0, & \text{if } C = 1\\ C, & \text{if } C > 1 \end{cases}$$

subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of $N_{\rm RB}$ resource blocks.
- b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].
- 3. If there is more than one *A* that minimizes the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.
- 4. For TDD, the measurement channel is based on DL/UL configuration ratio of 2DL+DwPTS (12 OFDM symbol): 2UL

A.3.1.1 Overview of DL reference measurement channels

In Table A.3.1.1-1 to A.3.1.1-1V are listed the DL reference measurement channels specified in annexes A.3.2 to A.3.10 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.3.2 to A.3.10 as appropriate.

Table A.3.1.1-1: Overview of DL reference measurement channels (FDD, Receiver requirements)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD	Table A.3.2-1		1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.2-1		3	QPSK	1/3	15		≥ 1	
FDD	Table A.3.2-1		5	QPSK	1/3	25		≥ 1	
FDD	Table A.3.2-1		10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.2-1		15	QPSK	1/3	75		≥ 1	
FDD	Table A.3.2-1		20	QPSK	1/3	100		≥ 1	
FDD / HD-FDD	Table A.3.2-1a		1.4	QPSK	1/3	6		1	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		3	QPSK	1/3	14		-	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		5	QPSK	1/3	14		ı	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		10	QPSK	1/3	14		ı	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		15	QPSK	1/3	14		-	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1a		20	QPSK	1/3	14		ı	UE DL Category 0
FDD / HD-FDD	Table A.3.2-1b		1.4	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		3	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		5	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		10	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		15	QPSK	1/3	4		M1	
FDD / HD-FDD	Table A.3.2-1b		20	QPSK	1/3	4		M1	
HD-FDD	Table A.3.2-1c		0.2	QPSK	1/3	1		NB1	
HD-FDD	Table A.3.2-1d		0.2	QPSK	1/3	1		NB1	

Table A.3.1.1-1A: Overview of DL reference measurement channels (TDD, Receiver requirements)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
TDD	Table A.3.2-2		1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.2-2		3	QPSK	1/3	15		≥ 1	
TDD	Table A.3.2-2		5	QPSK	1/3	25		≥ 1	
TDD	Table A.3.2-2		10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.2-2		15	QPSK	1/3	75		≥ 1	
TDD	Table A.3.2-2		20	QPSK	1/3	100		≥ 1	
TDD	Table A.3.2-2a		1.4	QPSK	1/3	6		-	UE DL Category 0
TDD	Table A.3.2-2a		3	QPSK	1/3	14		-	UE DL Category 0
TDD	Table A.3.2-2a		5	QPSK	1/3	14		-	UE DL Category 0
TDD	Table A.3.2-2a		10	QPSK	1/3	14		-	UE DL Category 0
TDD	Table A.3.2-2a		15	QPSK	1/3	14		-	UE DL Category 0
=	Table A.3.2-2a		20	QPSK	1/3	14		-	UE DL Category 0
TDD Band 46	Table A.3.2-2c		20	QPSK	1/3	100		≥ 3	
TDD	Table A.3.2-2b		1.4	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		3	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		5	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		10	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		15	QPSK	1/3	4		M1	
TDD	Table A.3.2-2b		20	QPSK	1/3	4		M1	

Table A.3.1.1-1B: Overview of DL reference measurement channels (FDD, Receiver requirements, Maximum input level)

Duplex	Table	Name	вw	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
UE Catego	ories ≥ 3								
FDD	Table A.3.2-3		1.4	64QAM	3/4	6		-	
FDD	Table A.3.2-3		3	64QAM	3/4	15		-	
FDD	Table A.3.2-3		5	64QAM	3/4	25		-	
FDD	Table A.3.2-3		10	64QAM	3/4	50		-	
FDD	Table A.3.2-3		15	64QAM	3/4	75		-	
FDD	Table A.3.2-3		20	64QAM	3/4	100		-	
UE Catego	ory 1								
FDD	Table A.3.2-3a		1.4	64QAM	3/4	6		-	
FDD	Table A.3.2-3a		3	64QAM	3/4	15		-	
FDD	Table A.3.2-3a		5	64QAM	3/4	18		-	
FDD	Table A.3.2-3a		10	64QAM	3/4	17		-	
FDD	Table A.3.2-3a		15	64QAM	3/4	17		-	
FDD	Table A.3.2-3a		20	64QAM	3/4	17		-	
UE Catego	ory 2								
FDD	Table A.3.2-3b		1.4	64QAM	3/4	6		-	
FDD	Table A.3.2-3b		3	64QAM	3/4	15		-	
FDD	Table A.3.2-3b		5	64QAM	3/4	25		-	
FDD	Table A.3.2-3b		10	64QAM	3/4	50		-	
FDD	Table A.3.2-3b		15	64QAM	3/4	75		-	
FDD	Table A.3.2-3b		20	64QAM	3/4	83		ı	
UE DL Ca	tegory 0								
FDD	Table A.3.2-3c		1.4	64QAM	3/4	2		-	
FDD	Table A.3.2-3c		3	64QAM	3/4	2		-	
FDD	Table A.3.2-3c		5	64QAM	3/4	2		-	
FDD	Table A.3.2-3c		10	64QAM	3/4	2		-	
FDD	Table A.3.2-3c		15	64QAM	3/4	2		-	
FDD	Table A.3.2-3c		20	64QAM	3/4	2		-	
UE DL Ca	tegory M1								
FDD/HD- FDD	Table A.3.2-3d		1.4	16QAM	3/5	2		-	
FDD/HD- FDD	Table A.3.2-3d		3	16QAM	3/5	2		-	
FDD/HD- FDD	Table A.3.2-3d		5	16QAM	3/5	2		-	
FDD/HD- FDD	Table A.3.2-3d		10	16QAM	3/5	2		-	
FDD/HD- FDD	Table A.3.2-3d		15	16QAM	3/5	2		-	
FDD/HD- FDD	Table A.3.2-3d		20	16QAM	3/5	2		-	

Table A.3.1.1-1C: Overview of DL reference measurement channels (TDD, Receiver requirements, Maximum input level)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
UE Catego	ories ≥ 3								
TDD	Table A.3.2-4		1.4	64QAM	3/4	6		-	
TDD	Table A.3.2-4		3	64QAM	3/4	15		-	
TDD	Table A.3.2-4		5	64QAM	3/4	25		-	
TDD	Table A.3.2-4		10	64QAM	3/4	50		-	
TDD	Table A.3.2-4		15	64QAM	3/4	75		-	
TDD	Table A.3.2-4		20	64QAM	3/4	100		-	
TDD Band 46	Table A.3.2-4d		20	64QAM	3/4	100		-	
UE Catego	ory 1			•					
TDD	Table A.3.2-4a		1.4	64QAM	3/4	6		-	
TDD	Table A.3.2-4a		3	64QAM	3/4	15		-	
TDD	Table A.3.2-4a		5	64QAM	3/4	18		-	
TDD	Table A.3.2-4a		10	64QAM	3/4	17		-	
TDD	Table A.3.2-4a		15	64QAM	3/4	17		-	
TDD	Table A.3.2-4a		20	64QAM	3/4	17		-	
UE Catego	ory 2								
TDD	Table A.3.2-4b		1.4	64QAM	3/4	6		-	
TDD	Table A.3.2-4b		3	64QAM	3/4	15		-	
TDD	Table A.3.2-4b		5	64QAM	3/4	25		-	
TDD	Table A.3.2-4b		10	64QAM	3/4	50		-	
TDD	Table A.3.2-4b		15	64QAM	3/4	75		-	
TDD	Table A.3.2-4b		20	64QAM	3/4	83		-	
UE DL Cat	egory 0			•					
TDD	Table A.3.2-4c		1.4	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		3	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		5	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		10	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		15	64QAM	3/4	2		-	
TDD	Table A.3.2-4c		20	64QAM	3/4	2		-	
UE Catego	ories 11/12 and UE [OL categories	≥ 11						
FDD	Table A.3.2-5		1.4	256QAM	4/5	6		-	
FDD	Table A.3.2-5		3	256QAM	4/5	15		-	
FDD	Table A.3.2-5		5	256QAM	4/5	25		ı	
FDD	Table A.3.2-5		10	256QAM	4/5	50		-	
FDD	Table A.3.2-5		15	256QAM	4/5	75		-	
FDD	Table A.3.2-5		20	256QAM	4/5	100		-	
UE Catego	ories 11/12 and UE	OL categories	≥ 11						
TDD	Table A.3.2-6		1.4	256QAM	4/5	6		-	
TDD	Table A.3.2-6		3	256QAM	4/5	15		-	
TDD	Table A.3.2-6		5	256QAM	4/5	25		-	
TDD	Table A.3.2-6		10	256QAM	4/5	50		-	
TDD	Table A.3.2-6		15	256QAM	4/5	75		-	
TDD	Table A.3.2-6		20	256QAM	4/5	100		-	
			ļ	<u> </u>	<u> </u>	<u> </u>	!		ļ

TDD Band 46	Table A.3.2-7		20	256QAM	4/5	100		-		
UE DL Category M1										
TDD	Table A.3.2-4e		1.4	16QAM	3/5	2		ı		
TDD	Table A.3.2-4e		3	16QAM	3/5	2		-		
TDD	Table A.3.2-4e		5	16QAM	3/5	2		-		
TDD	Table A.3.2-4e		10	16QAM	3/5	2		-		
TDD	Table A.3.2-4e		15	16QAM	3/5	2		-		
TDD	Table A.3.2-4e		20	16QAM	3/5	2		-		

Table A.3.1.1-1D: Overview of DL reference measurement channels (FDD, PDSCH Performance, Single-antenna transmission (CRS))

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD	Table A.3.3.1-1	R.4 FDD	1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.3.1-1	R.42 FDD	20	QPSK	1/3	100		≥ 1	
FDD	Table A.3.3.1-1	R.42-1 FDD	3	QPSK	1/3	15		≥ 1	
FDD	Table A.3.3.1-1	R.42-2 FDD	5	QPSK	1/3	25		≥ 1	
FDD	Table A.3.3.1-1	R.42-3 FDD	15	QPSK	1/3	75		≥ 1	
FDD	Table A.3.3.1-1	R.2 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.1-2	R.3-1 FDD	5	16QAM	1/2	25		≥ 1	
FDD	Table A.3.3.1-2	R.3 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.1-3	R.5 FDD	3	64QAM	3/4	15		≥ 1	
FDD	Table A.3.3.1-3	R.6 FDD	5	64QAM	3/4	25		≥ 2	
FDD	Table A.3.3.1-3	R.7 FDD	10	64QAM	3/4	50		≥ 2	
FDD	Table A.3.3.1-3	R.8 FDD	15	64QAM	3/4	75		≥ 2	
FDD	Table A.3.3.1-3	R.9 FDD	20	64QAM	3/4	100		≥ 3	
FDD	Table A.3.3.1-3a	R.6-1 FDD	5	64QAM	3/4	18		≥ 1	
FDD	Table A.3.3.1-3a	R.7-1 FDD	10	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.8-1 FDD	15	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.9-1 FDD	20	64QAM	3/4	17		≥ 1	
FDD	Table A.3.3.1-3a	R.9-2 FDD	20	64QAM	3/4	83		≥ 2	
FDD	Table A.3.3.1-6	R.41 FDD	10	QPSK	1/10	50		≥ 1	
Single PR	B (Channel edge)								
FDD	Table A.3.3.1-4	R.0 FDD	3	16QAM	1/2	1		≥ 1	
FDD	Table A.3.3.1-4	R.1 FDD	10 / 20	16QAM	1/2	1		≥ 1	
Single PR	B (MBSFN Configu	ration)							
FDD	Table A.3.3.1-5	R.29 FDD	10	16QAM	1/2	1		≥ 1	

Table A.3.1.1-1E: Overview of DL reference measurement channels (PDSCH Performance: Carrier aggregation with power imbalance)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD									
FDD	Table A.3.3.1-7	R.49 FDD	20	64QAM	0.84- 0.87	100		≥ 5	
FDD	Table A.3.3.1-7	R.49-1 FDD	10	64QAM	0.84- 0.87	50		≥2	
FDD	Table A.3.3.1-7	R.49-2 FDD	5	64QAM	0.84- 0.86	25		≥2	
TDD									
TDD	Table A.3.4.1-7	R.49 TDD	20	64QAM	0.81- 087	100		≥ 5	
TDD	Table A.3.4.1-7	R.49-1 TDD	15	64QAM	0.80- 0.86	75		≥ 3	

Table A.3.1.1-1F: Overview of DL reference measurement channels (FDD, PDSCH Performance, Multi-antenna transmission (CRS))

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
Two anter	nna ports							_	
FDD	Table A.3.3.2.1-1	R.10 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.2.1-1	R.11 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.11-1 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.11-2 FDD	5	16QAM	1/2	25		≥ 1	
FDD	Table A.3.3.2.1-1	R.11-3 FDD	10	16QAM	1/2	40		≥ 1	
FDD	Table A.3.3.2.1-1	R.11-4 FDD	10	QPSK	1/2	50		≥ 1	
FDD	Table A.3.3.2.1-1	R.30 FDD	20	16QAM	1/2	100		≥ 2	
FDD	Table A.3.3.2.1-1	R.30-1 FDD	15	16QAM	1/2	75		≥ 2	
FDD	Table A.3.3.2.1-1	R.35 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.2.1-1	R.35-1 FDD	20	64QAM	0.39	100		4	
FDD	Table A.3.3.2.1-1	R.35-2 FDD	15	64QAM	0.39	75		≥ 2	
FDD	Table A.3.3.2.1-1	R.35-3 FDD	10	64QAM	0.39	50		≥ 2	
FDD	Table A.3.3.2.1-2	R.35-4 FDD	10	64QAM	0.47	50		≥ 2	
FDD	Table A.3.3.2.1-2	R.46 FDD	10	QPSK		50		≥ 1	
FDD	Table A.3.3.2.1-2	R.47 FDD	10	16QAM		50		≥ 1	
FDD	Table A.3.3.2.1-2	R.11-5 FDD	1.4	16QAM	1/2	6		≥ 1	
FDD	Table A.3.3.2.1-2	R.11-6 FDD	3	16QAM	1/2	15		≥ 1	
FDD	Table A.3.3.2.1-2	R.11-7 FDD	15	16QAM	1/2	75		≥ 2	
FDD	Table A.3.3.2.1-2	R.11-8 FDD	10	QPSK	3/5	50		≥ 2	
FDD	Table A.3.3.2.1-2	R.11-9 FDD	10	QPSK	0.58	50		≥ 1	
FDD	Table A.3.3.2.1-2	R.11-10 FDD	10	QPSK	0.67	50		≥ 1	
FDD	Table A.3.3.2.1-2	R.10-2 FDD	5	QPSK	1/3	25		≥ 1	
FDD	Table A.3.3.2.1-2	R.10-3 FDD	10	16QAM	0.58	50		≥ 2	

FDD	Table A.3.3.2.1-2	R.65 FDD	10	256QAM	0.55	50	11- 15	
FDD	Table A.3.3.2.1-3	R. 62 FDD	10	16QAM	1/2	3	0	
FDD	Table A.3.3.2.1-3	R.63 FDD	10	64QAM	1/2	1	0	
FDD	Table A.3.3.2.1-4	R.79 FDD	10	16QAM	1/2	3	M1, ≥ 0	
FDD	Table A.3.3.2.1-5	R.81 FDD	10	QPSK	1/10	6	M1, ≥ 0	
Four ante	nna ports							
FDD	Table A.3.3.2.2-1	R.12 FDD	1.4	QPSK	1/3	6	≥ 1	
FDD	Table A.3.3.2.2-1	R.13 FDD	10	QPSK	1/3	50	≥ 1	
FDD	Table A.3.3.2.2-1	R.14 FDD	10	16QAM	1/2	50	≥ 2	
FDD	Table A.3.3.2.2-1	R.14-1 FDD	10	16QAM	1/2	6	≥ 1	
FDD	Table A.3.3.2.2-1	R.14-2 FDD	10	16QAM	1/2	3	≥ 1	
FDD	Table A.3.3.2.2-1	R.14-3 FDD	20	16QAM	1/2	100	≥ 2	
FDD	Table A.3.3.2.2-1	R.36 FDD	10	64QAM	1/2	50	≥ 2	
FDD	Table A.3.3.2.2-1	R.14-4 FDD	1.4	16QAM	1/2	6	≥ 1	
FDD	Table A.3.3.2.2-1	R.14-5 FDD	3	16QAM	1/2	15	≥ 1	
FDD	Table A.3.3.2.2-1	R.14-6 FDD	5	16QAM	1/2	25	≥ 1	
FDD	Table A.3.3.2.2-1	R.14-7 FDD	15	16QAM	1/2	75	≥ 2	
FDD	Table A.3.3.2.2-1	R.72 FDD	10	256QAM	0.62	50	≥ 11	
FDD	Table A.3.3.2.2-1	R.73 FDD	10	64QAM	0.43	50	≥ 5	
FDD	Table A.3.3.2.2-1	R.74 FDD	10	16QAM	1/2	50	≥ 5	

Table A.3.1.1-1G: Overview of DL reference measurement channels (FDD, PDSCH Performance (UE specific RS))

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
Without C	SI-RS								
FDD	Table A.3.3.3.0-1	R.70 FDD	10	QPSK	0.65	50		≥ 1	
FDD	Table A.3.3.3.0-1	R.71 FDD	10	16QAM	0.6	50		≥ 2	
FDD	Table A.3.3.3.0-2	R.80 FDD	10	QPSK	1/3	6		M1, ≥ 0	
Two anter	nna ports (CSI-RS)								
FDD	Table A.3.3.3.1-1	R.51 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.1-1	R.51-1 FDD	10	16QAM	0.54	50		≥ 2	

FDD	Table A.3.3.3.1-1	R.76 FDD	10	QPSK		50		≥ 2	
Two antenna ports (CSI-RS, non Quasi Co-located)									
FDD	Table A.3.3.3.1-2	R.52 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.1-2	R.52-1 FDD	10	16QAM	0.54	50		≥ 2	
FDD	Table A.3.3.3.1-2	R.53 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.1-2	R.54 FDD	10	16QAM	1/2	50		≥ 2	
Four ante	nna ports (CSI-RS)								
FDD	Table A.3.3.3.2-1	R.43 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.3.2-1	R.50 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2-2	R.50A-1 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2-2	R.44 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.3.3.2-2	R.45 FDD	10	16QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2-2	R.45-1 FDD	10	16QAM	1/2	39		≥ 1	
FDD	Table A.3.3.3.2-1	R.48 FDD	10	QPSK		50		≥ 1	
FDD	Table A.3.3.3.2-2	R.60 FDD	10	QPSK	1/2	50		≥ 1	
FDD	Table A.3.3.3.2-3	R.64 FDD	10	QPSK	1/3	6		0	
FDD	Table A.3.3.3.2-1	R.66 FDD	10	256QAM	0.77	50		11- 15	
FDD	Table A.3.3.3.2-4	R.69 FDD	10	QPSK	0.74- 0.8	50		≥ 1	
FDD	Table A.3.3.3.2-1	R.75 FDD	10	16QAM	0.57	50		≥ 5	
Eight ante	enna ports (CSI-RS)								
FDD	Table A.3.3.3.2A-1	R.50A-2 FDD	10	64QAM	1/2	50		≥ 2	
FDD	Table A.3.3.3.2A-1	R.50A-3 FDD	10	64QAM	1/2	50		≥ 2	
Twelve antenna ports (CSI-RS)									
FDD	Table A.3.3.3.3-1	R.77 FDD	10	64QAM	1/2	50		≥ 2	
Sixteen antenna ports (CSI-RS)									
FDD	Table A.3.3.3.4-1	R.78 FDD	10	16QAM	1/2	50		≥ 2	

Table A.3.1.1-1H: Overview of DL reference measurement channels (TDD, PDSCH Performance, Single-antenna transmission (CRS))

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
TDD	Table A.3.4.1-1	R.4 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.4.1-1	R.42 TDD	20	QPSK	1/3	100		≥ 1	
TDD	Table A.3.4.1-1	R.2 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.1-1	R.2A TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.1-1	R.42-1 TDD	3	QPSK	1/3	15		≥ 1	
TDD	Table A.3.4.1-1	R.42-2 TDD	5	QPSK	1/3	25		≥ 1	
TDD	Table A.3.4.1-1	R.42-3 TDD	15	QPSK	1/3	75		≥ 1	
TDD	Table A.3.4.1-2	R.3-1 TDD	5	16QAM	1/2	25		≥ 1	
TDD	Table A.3.4.1-2	R.3 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.1-3	R.5 TDD	3	64QAM	3/4	15		≥ 1	
TDD	Table A.3.4.1-3	R.6 TDD	5	64QAM	3/4	25		≥ 2	
TDD	Table A.3.4.1-3	R.7 TDD	10	64QAM	3/4	50		≥ 2	
TDD	Table A.3.4.1-3	R.8 TDD	15	64QAM	3/4	75		≥ 2	
TDD	Table A.3.4.1-3	R.9 TDD	20	64QAM	3/4	100		≥ 3	
TDD	Table A.3.4.1-3a	R.6-1 TDD	5	64QAM	3/4	18		≥ 1	
TDD	Table A.3.4.1-3a	R.7-1 TDD	10	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.8-1 TDD	15	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.9-1 TDD	20	64QAM	3/4	17		≥ 1	
TDD	Table A.3.4.1-3a	R.9-2 TDD	20	64QAM	3/4	83		≥ 2	
TDD	Table A.3.4.1-6	R.41 TDD	10	QPSK	1/10	50		≥ 1	
Single PRB (Channel edge)									
TDD	Table A.3.4.1-4	R.0 TDD	3	16QAM	1/2	1		≥ 1	
TDD	Table A.3.4.1-4	R.1 TDD	10 / 20	16QAM	1/2	1		≥ 1	
Single PR	B (MBSFN Configu	ration)							
TDD	Table A.3.4.1-5	R.29 TDD	10	16QAM	1/2	1		≥ 1	

Table A.3.1.1-1I: Overview of DL reference measurement channels (TDD, PDSCH Performance, Multi-antenna transmission (CRS))

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes	
Two antenna ports										
TDD	Table A.3.4.2.1-1	R.10 TDD	10	QPSK	1/3	50		≥ 1		
TDD	Table A.3.4.2.1-1	R.11 TDD	10	16QAM	1/2	50		≥ 2		
TDD	Table A.3.4.2.1-1	R.11-1 TDD	10	16QAM	1/2	50		≥ 2		
TDD	Table A.3.4.2.1-1	R.11-2 TDD	5	16QAM	1/2	25		≥ 1		
TDD	Table A.3.4.2.1-1	R.11-3 TDD	10	16QAM	1/2	40		≥ 1		
TDD	Table A.3.4.2.1-1	R.11-4 TDD	10	QPSK	1/2	50		≥ 1		
TDD	Table A.3.4.2.1-1	R.30 TDD	20	16QAM	1/2	100		≥ 2		
TDD	Table A.3.4.2.1-1	R.30-1 TDD	20	16QAM	1/2	100		≥ 2		
TDD	Table A.3.4.2.1-1	R.30-2 TDD	20	16QAM	1/2	100		3		
TDD	Table A.3.4.2.1-1	R.35 TDD	10	64QAM	1/2	50		≥ 2		
TDD	Table A.3.4.2.1-1	R.35-1 TDD	20	64QAM	0.39	100		4		
TDD	Table A.3.4.2.1-2	R.35-2 TDD	10	64QAM	0.47	50		≥ 2		
TDD	Table A.3.4.2.1-2	R.46 TDD	10	QPSK		50		≥ 1		
TDD	Table A.3.4.2.1-2	R.47 TDD	10	16QAM		50		≥ 1		
TDD	Table A.3.4.2.1-2	R.11-5 TDD	1.4	16QAM	1/2	6		≥ 1		
TDD	Table A.3.4.2.1-2	R.11-6 TDD	3	16QAM	1/2	15		≥ 1		
TDD	Table A.3.4.2.1-2	R.11-7 TDD	5	16QAM	1/2	25		≥ 1		
TDD	Table A.3.4.2.1-2	R.11-8 TDD	10	16QAM	1/2	50		≥ 2		
TDD	Table A.3.4.2.1-2	R.11-9 TDD	15	16QAM	1/2	75		≥ 2		
TDD	Table A.3.4.2.1-2	R.11-10 TDD	10	QPSK	3/5	50		≥ 2		
TDD	Table A.3.4.2.1-2	R.11-11 TDD	10	QPSK	0.48- 0.58	50		≥ 1		
TDD	Table A.3.4.2.1-2	R.11-12 TDD	10	QPSK	0.54- 0.66	50		≥ 1		
TDD	Table A.3.4.2.1-2	R.10-3 TDD	10	16QAM	0.57- 0.58	50		≥ 1		

TDD	Table A.3.4.2.1-3	R.62 TDD	10	16QAM	1/2	3		0		
TDD	Table A.3.4.2.1-3	R.63 TDD	10	64QAM	1/2	1		0		
TDD	Table A.3.4.2.1-4	R.65 TDD	20	256QAM	0.6	100		11- 15		
TDD	Table A.3.4.2.1-5	R.67 TDD	10	16QAM	0.4	50		≥ 1		
TDD	Table A.3.4.2.1-6	R.79 TDD	10	16QAM	1/2	3		M1, ≥ 0		
TDD	Table A.3.4.2.1-7	R.81 TDD	10	QPSK	1/10	6		M1, ≥ 0		
Four ante	Four antenna ports									
TDD	Table A.3.4.2.2-1	R.12 TDD	1.4	QPSK	1/3	6		≥ 1		
TDD	Table A.3.4.2.2-1	R.13 TDD	10	QPSK	1/3	50		≥ 1		
TDD	Table A.3.4.2.2-1	R.14 TDD	10	16QAM	1/2	50		≥ 2		
TDD	Table A.3.4.2.2-1	R.14-1 TDD	10	16QAM	1/2	6		≥ 1		
TDD	Table A.3.4.2.2-1	R.14-2 TDD	10	16QAM	1/2	3		≥ 1		
TDD	Table A.3.4.2.2-1	R.43 TDD	20	16QAM	1/2	100		≥2		
TDD	Table A.3.4.2.2-1	R.36 TDD	10	64QAM	1/2	50		≥ 2		
TDD	Table A.3.4.2.2-1	R.43-1 TDD	1.4	16QAM	1/2	6		≥ 1		
TDD	Table A.3.4.2.2-1	R.43-2 TDD	3	16QAM	1/2	15		≥ 1		
TDD	Table A.3.4.2.2-1	R.43-3 TDD	5	16QAM	1/2	25		≥ 1		
TDD	Table A.3.4.2.2-1	R.43-4 TDD	10	16QAM	1/2	50		≥ 2		
TDD	Table A.3.4.2.2-1	R.43-5 TDD	15	16QAM	1/2	75		≥ 2		
TDD	Table A.3.4.2.2-1	R.72 TDD	10	256QAM	0.62	50		≥ 11		
TDD	Table A.3.4.2.2-1	R.73 TDD	10	64QAM	0.44	50		≥ 5		
TDD	Table A.3.4.2.2-1	R.74 TDD	10	16QAM	1/2	50		≥ 5		

Table A.3.1.1-1J: Overview of DL reference measurement channels (TDD, PDSCH Performance (DRS))

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes	
Single antenna port										
TDD	Table A.3.4.3.1-1	R.25 TDD	10	QPSK	1/3	50		≥ 1		
TDD	Table A.3.4.3.1-1	R.26 TDD	10	16QAM	1/2	50		≥ 2		
TDD	Table A.3.4.3.1-1	R.26-1 TDD	5	16QAM	1/2	25		≥ 1		
TDD	Table A.3.4.3.1-1	R.27 TDD	10	64QAM	3/4	50		≥ 2		
TDD	Table A.3.4.3.1-1	R.27-1 TDD	10	64QAM	3/4	18		≥ 1		
TDD	Table A.3.4.3.1-1	R.28 TDD	10	16QAM	1/2	1		≥ 1		
TDD	Table A.3.4.3.1-2	R.80 TDD	10	QPSK	1/3	6		M1, ≥ 0		
Two anter	nna ports									
TDD	Table A.3.4.3.2-1	R.31 TDD	10	QPSK	1/3	50		≥ 1		
TDD	Table A.3.4.3.2-1	R.32 TDD	10	16QAM	1/2	50		≥ 2		
TDD	Table A.3.4.3.2-1	R.32-1 TDD	5	16QAM	1/2	[25]		≥ 1		
TDD	Table A.3.4.3.2-1	R.33 TDD	10	64QAM	3/4	50		≥ 2		
TDD	Table A.3.4.3.2-1	R.33-1 TDD	10	64QAM	3/4	[18]		≥ 1		
TDD	Table A.3.4.3.2-1	R.34 TDD	10	64QAM	1/2	50		≥ 2		
TDD	Table A.3.4.3.2	R.70 TDD	10	QPSK	0.54- 0.65	50		≥ 1		
TDD	Table A.3.4.3.2	R.71 TDD	10	16QAM	0.5- 0.6	50		≥ 2		

Table A.3.1.1-1K: Overview of DL reference measurement channels (TDD, PDSCH Performance (UE specific RS))

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
Two anter	nna ports (CSI-RS)								
TDD	Table A.3.4.3.3-1	R.51 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.3-1	R.51-1 TDD	10	16QAM	0.57	50		≥ 2	
TDD	Table A.3.4.3.1-1	R.76 FDD	10	QPSK		50		≥ 2	
Two anter	nna ports (CSI-RS, ı	non Quasi Co-l	ocated)						
TDD	Table A.3.4.3.3-2	R.52 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.3-2	R.52-1 TDD	10	16QAM	0.57	50		≥ 2	
TDD	Table A.3.4.3.3-2	R.53 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.3-2	R.54 TDD	10	16QAM	1/2	50		≥ 2	
Four ante	nna ports (CSI-RS)								
TDD	Table A.3.4.3.4-1	R.44 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.4-5	R.44A-1 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.4-1	R.48 TDD	10	QPSK		50		≥ 1	
TDD	Table A.3.4.3.4-2	R.60 TDD	10	QPSK	1/2	50		≥ 1	
TDD	Table A.3.4.3.4-2	R.61 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.4-2	R.61-1 TDD	10	16QAM	1/2	39		≥ 1	
TDD	Table A.3.4.3.4-3	R.64 TDD	10	QPSK	1/3	6		0	
TDD	Table A.3.4.3.4-1	R.66 TDD	20	256QAM		100		11- 15	
TDD	Table A.3.4.3.4-4	R.69 TDD	10	QPSK	0.61- 0.8	50		≥ 1	
TDD	Table A.3.4.3.4-1	R.75 TDD	10	16QAM	0.57	50		≥ 5	
Eight ante	enna ports (CSI-RS)								
TDD	Table A.3.4.3.5-1	R.50 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.4.3.5-2	R.45 TDD	10	16QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.5-2	R.45-1 TDD	10	16QAM	1/2	39		≥ 1	
TDD	Table A.3.4.3.5-2	R.45-2 TDD	10	64QAM		50		≥ 2	
TDD	Table A.3.4.3.5-3	R.44A-2 TDD	10	64QAM	1/2	50		≥ 2	
TDD	Table A.3.4.3.5-3	R.44A-3 TDD	10	64QAM	1/2	50		≥ 2	
Twelve an	tenna ports (CSI-R	S)							
TDD	Table A.3.4.3.6-1	R.77 TDD	10	64QAM	1/2	50		≥ 2	
Sixteen ar	ntenna ports (CSI-R	S)							
TDD	Table A.3.4.3.7-1	R.78 TDD	10	16QAM	1/2	50		≥ 2	

Table A.3.1.1-1L: Overview of DL reference measurement channels (PDCCH / PCFICH Performance)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off	UE Cat	Notes
FDD							set	eg	
FDD	Table A.3.5.1-1	R.15 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.15-1 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.15-2 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.16 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.16-1 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.16-2 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.16-3 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.16-4 FDD	10	PDCCH					
FDD	Table A.3.5.1-1	R.17 FDD	5	PDCCH					
TDD									
TDD	Table A.3.5.2-1	R.15 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.15-1 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.15-2 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.16 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.16-1 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.16-2 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.16-3 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.16-4 TDD	10	PDCCH					
TDD	Table A.3.5.2-1	R.17 TDD	5	PDCCH					
FS3									
FS3	Table A.3.5.3-1	R.3 FS3	20	PDCCH					
FS3	Table A.3.5.3-2	R.4 FS3	20	PDCCH					

Table A.3.1.1-1M: Overview of DL reference measurement channels (PHICH Performance)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD / TDD	Table A.3.6-1	R.18	10	PHICH					
FDD / TDD	Table A.3.6-1	R.19	10	PHICH					
FDD	Table A.3.6.1	R.19-1	5	PHICH					
FDD / TDD	Table A.3.6-1	R.20	5	PHICH					
FDD / TDD	Table A.3.6-1	R.24	10	PHICH					

Table A.3.1.1-1N: Overview of DL reference measurement channels (PBCH Performance)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD / TDD	Table A.3.7-1	R.21	1.4	QPSK	40/ 1920				
FDD / TDD	Table A.3.7-1	R.22	1.4	QPSK	40/ 1920				
FDD / TDD	Table A.3.7-1	R.23	1.4	QPSK	40/ 1920				

Table A.3.1.1-10: Overview of DL reference measurement channels (PMCH Performance)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD									
FDD	Table A.3.8.1-1	R.40 FDD	1.4	QPSK	1/3	6		≥ 1	
FDD	Table A.3.8.1-1	R.37 FDD	10	QPSK	1/3	50		≥ 1	
FDD	Table A.3.8.1-2	R.38 FDD	10	16QAM	1/2	50		≥ 1	
FDD	Table A.3.8.1-3	R.39-1 FDD	5	64QAM	2/3	25		≥ 1	
FDD	Table A.3.8.1-3	R.39 FDD	10	64QAM	2/3	50		≥ 2	
TDD									
TDD	Table A.3.8.2-1	R.40 TDD	1.4	QPSK	1/3	6		≥ 1	
TDD	Table A.3.8.2-1	R.37 TDD	10	QPSK	1/3	50		≥ 1	
TDD	Table A.3.8.2-2	R.38 TDD	10	16QAM	1/2	50		≥ 1	
TDD	Table A.3.8.2-3	R.39-1 TDD	5	64QAM	2/3	25		≥ 1	
TDD	Table A.3.8.2-3	R.39 TDD	10	64QAM	2/3	50		≥ 2	

Table A.3.1.1-1P: Overview of DL reference measurement channels (Sustained data rate)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD								_ J	
FDD	Table A.3.9.1-1	R.31-1 FDD	10	64QAM	0.40			≥ 1	
FDD	Table A.3.9.1-1	R.31-2 FDD	10	64QAM	0.59- 0.64			≥ 2	
FDD	Table A.3.9.1-1	R.31-3 FDD	20	64QAM	0.59- 0.62			≥ 2	
FDD	Table A.3.9.1-1	R.31-3A FDD	10	64QAM	0.85- 0.90			≥ 2	
FDD	Table A.3.9.1-1	R.31-3C FDD	15	64QAM	0.87- 0.91			≥ 3	
FDD	Table A.3.9.1-1	R.31-4 FDD	20	64QAM	0.87- 0.90			≥ 3	
FDD	Table A.3.9.1-1	R.31-4B FDD	15	64QAM	0.85- 0.88			≥ 4	
FDD	Table A.3.9.1-1	R.31-5 FDD	15	64QAM	0.85- 0.91			≥ 3	
FDD	Table A.3.9.1-2	R.31-6 FDD	5	64QAM	0.83- 0.85			≥ 2	
FDD	Table A.3.9.1-3	R.68 FDD	20	256QAM	0.74- 0.85			11- 12	
FDD	Table A.3.9.1-3	R.68-1 FDD	15	256QAM	0.74- 0.88			11- 12	
FDD	Table A.3.9.1-3	R.68-2 FDD	10	256QAM	0.74- 0.85			11- 12	
FDD	Table A.3.9.1-3	R.68-3 FDD	5	256QAM	0.77- 0.85			11- 12	
TDD				•					
TDD	Table A.3.9.2-1	R.31-1 TDD	10	64QAM	0.40			≥ 1	
TDD	Table A.3.9.2-1	R.31-2 TDD	10	64QAM	0.59- 0.64			≥ 2	
TDD	Table A.3.9.2-1	R.31-3 TDD	20	64QAM	0.59- 0.62			≥ 2	
TDD	Table A.3.9.2-1	R.31-3A TDD	15	64QAM	0.87- 0.90			≥ 2	
TDD	Table A.3.9.2-1	R.31-4 TDD	20	64QAM	0.87- 0.90			≥ 3	
TDD	Table A.3.9.2-1	R.31-4A TDD	20	64QAM	0.87- 0.90			≥ 3	
TDD	Table A.3.9.2-1	R.31-5 TDD	15	64QAM	0.85- 0.88			≥ 3	
TDD	Table A.3.9.2-1	R.31-5A TDD	15	64QAM	0.85- 0.88			≥ 3	
TDD	Table A.3.9.2-1	R.31-6 TDD	10	64QAM	0.85- 0.88			≥ 2	
TDD	Table A.3.9.2-2	R.68 TDD	20	256QAM				11- 12	
TDD	Table A.3.9.2-2	R.68-1 TDD	15	256QAM				11- 12	
TDD	Table A.3.9.2-2	R.68-2 TDD	10	256QAM				11- 12	
TDD	Table A.3.9.2-2	R.68-3 TDD	20	256QAM				11- 12	
TDD	Table A.3.9.2-2	R.68-4 TDD	15	256QAM				11- 12	
FDD, EPD	CCH scheduling								
FDD	Table A.3.9.3-1	R.31E-1 FDD	10	64QAM	0.40- 0			≥ 1	
FDD	Table A.3.9.3-1	R.31E-2 FDD	10	64QAM	0.59- 0.66			≥ 2	
FDD	Table A.3.9.3-1	R.31E-3 FDD	20	64QAM	0.59- 0.63			≥ 2	
FDD	Table A.3.9.1-1	R.31E-3C FDD	15	64QAM	0.87- 0.92			≥ 3	
FDD	Table A.3.9.3-1	R.31E-3A FDD	10	64QAM	0.85- 0.92			≥ 2	
FDD	Table A.3.9.3-1	R.31E-4 FDD	20	64QAM	0.87- 0.91			≥ 3	

FDD	Table A.3.9.1-1	R.31E-4B FDD	15	64QAM	0.87- 0.90		≥ 4	
TDD, EPD	CCH scheduling							
TDD	Table A.3.9.4-1	R.31E-1 TDD	10	64QAM	0.40- 0.41		≥ 1	
TDD	Table A.3.9.4-1	R.31E-2 TDD	10	64QAM	0.59- 0.65		≥ 2	
TDD	Table A.3.9.4-1	R.31E-3 TDD	20	64QAM	0.59- 0.63		≥ 2	
TDD	Table A.3.9.4-1	R.31E-3A TDD	15	64QAM	0.87- 0.92		≥ 2	
TDD	Table A.3.9.4-1	R.31E-4 TDD	20	64QAM	0.87- 0.90		≥ 3	

Table A.3.1.1-1Q: Overview of DL reference measurement channels (EPDCCH)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD								-9	
FDD	Table A.3.10.1-1	R.55 FDD	10	EPDCC H					
FDD	Table A.3.10.1-1	R.55-1 FDD	10	EPDCC H					
FDD	Table A.3.10.1-1	R.56 FDD	10	EPDCC H					
FDD	Table A.3.10.1-1	R.57 FDD	10	EPDCC H					
FDD	Table A.3.10.1-1	R.58 FDD	10	EPDCC H					
FDD	Table A.3.10.1-1	R.59 FDD	10	EPDCC H					
TDD									
TDD	Table A.3.10.2-1	R.55 TDD	10	EPDCC H					
TDD	Table A.3.10.2-1	R.55-1 TDD	10	EPDCC H					
TDD	Table A.3.10.2-1	R.56 TDD	10	EPDCC H					
TDD	Table A.3.10.2-1	R.57 TDD	10	EPDCC H					
TDD	Table A.3.10.2-1	R.58 TDD	10	EPDCC H					
TDD	Table A.3.10.2-1	R.59 TDD	10	EPDCC H					

Table A.3.1.1-1R: Overview of DL reference measurement channels (MPDCCH)

Duplex	Table	Name	BW	Mod	TCR	RB	RB Off set	UE Cat eg	Notes
FDD									
FDD	Table A.3.11.1-1	R.82 FDD	10	MPDCC H					
FDD	Table A.3.11.1-1	R.83 FDD	10	MPDCC H					
TDD									
TDD	Table A.3.11.2-1	R.82 TDD	10	MPDCC H					
TDD	Table A.3.11.2-1	R.83 TDD	10	MPDCC H					

Table A.3.1.1-1S: Overview of DL reference measurement channels (NPDSCH)

Duplex	Table	Name	BW(KHz)	Mod	TC R	RB	RB Off set	UE Cat eg	Notes
FDD									
HD-FDD	Table A.3.12.1.2-1	R.NB.5 FDD	200	QPSK	1/3			NB1	
HD-FDD	Table A.3.12.1.2-1	R.NB.5-1 FDD	200	QPSK	1/3			NB1	
HD-FDD	Table A.3.12.2.1-1	R.NB.6 FDD	200	QPSK	1/2			NB1	
HD-FDD	Table A.3.12.2.1-1	R.NB.6-1 FDD	200	QPSK	1/3			NB1	

Table A.3.1.1-1T: Overview of DL reference measurement channels (NPDCCH)

Duplex	Table	Name	BW(KHz)	Mod	TC R	RB	RB Off set	UE Cat eg	Notes
FDD									
HD-FDD	Table A.3.13.1-1	R.NB.3 FDD	200	QPSK				NB1	
HD-FDD	Table A.3.13.1-1	R.NB.4 FDD	200	QPSK				NB1	

Table A.3.1.1-1U: Overview of DL reference measurement channels (NPBCH)

Duplex	Table	Name	BW(KHz)	Mod	TC R	RB	RB Off set	UE Cat eg	Notes
FDD									
HD-FDD	Table A.3.14-1	R.NB.1 FDD	200	QPSK				NB1	
HD-FDD	Table A.3.14-1	R.NB.2 FDD	200	QPSK				NB1	

end partial SF not supporting both

initial and end partial

SF

supporting end partial

SF supporting initial partial

SF but not supporting

end partial SF not supporting both

initial and end partial

SF supporting end partial

SF supporting initial partial

SF but not supporting

end partial SF

FS3

FS3

FS3

FS3

FS3

FS3

Table A.3.9.5-2

Table A.3.9.5-2

Table A.3.9.5-2

Table A.3.9.5-2

Table A.3.9.5-2

Table A.3.9.5-2

RR HF Duplex **Table** Name BW Mod **TCR** RB Off Cat **Notes** set eg FS₃ 64QAM FS3 Table A.3.5.1.1-2 R.1 FS3 0.6 100 ≥ 5 16QAM FS3 Table A.3.15.2.1-1 R.2 FS3 20 1/2 100 ≥ 5 0.88not supporting both FS3 Table A.3.9.5-1 R.5 FS3 20 64QAM 100 ≥ 5 0.89 initial and end partial SF 64QAM 0.77supporting end partial Table A.3.9.5-1 R.6 FS3 100 ≥ 5 FS3 20 0.89 64QAM supporting initial partial 0.88-FS3 Table A.3.9.5-1 100 ≥ 5 SF but not supporting **R.7 FS3** 20 0.90 end partial SF 0.79not supporting both Table A.3.9.5-1 64QAM FS3 R.8 FS3 20 100 ≥ 5 0.80 initial and end partial SF 64QAM 0.79supporting end partial FS3 Table A.3.9.5-1 R.9 FS3 20 100 ≥ 5 0.82 SF 64QAM supporting initial partial 0.79-FS3 Table A.3.9.5-1 R.10 FS3 20 100 ≥ 5 SF but not supporting 0.81

256QAM

256QAM

256QAM

256QAM

256QAM

256QAM

0.75-

0.85

0.74-

0.85

0.74-

0.85

0.78-

0.79

0.74-

0.79

0.77-

0.79

100

100

100

100

100

100

≥ 11

≥ 11

≥ 11

≥ 11

≥ 11

≥ 11

Table A.3.1.1-1V: Overview of DL reference measurement channels (FS3)

A.3.2 Reference measurement channel for receiver characteristics

R.11 FS3

R.12 FS3

R.13 FS3

R.14 FS3

R.15 FS3

R.16 FS3

20

20

20

20

20

20

Unless otherwise stated, Tables A.3.2-1, A.3.2-1a, A.3.2-1b, A.3.2-2, A.3.2-2a and A.3.2-2b are applicable for measurements on the Receiver Characteristics (clause 7) with the exception of subclause 7.4 (Maximum input level).

Unless otherwise stated, Tables A.3.2-3, A.3.2-3a, A.3.2-3b, A.3.2-4, A.3.2-4a and A.3.2-4b are applicable for subclause 7.4 (Maximum input level).

Unless otherwise stated, Tables A.3.2-1, A.3.2-1a, A.3.2-1b, A.3.2-2, A.3.2-2a and A.3.2-2b also apply for the modulated interferer used in Clauses 7.5, 7.6 and 7.8 with test specific bandwidths.

For transmissions in TDD Band 46, Table A.3.2-2c is applicable for measurements of Receiver Characteristics (clause 7) except for the Maximum Input Level (clause 7.4A) for which Table A.3.2-4d and Table A.3.2-7 apply. For these measurements, the discovery signals measurement timing configuration (DMTC) periodicity shall be set at *dmtc-Periodicity* = 40 ms with an offset *dmtc-Offset* = 0 for the channel and the DRS shall be transmitted in the first subframe of each DMTC occasion. Furthermore, no PBCH is transmitted and the PDSCH is also scheduled in subframe #5.

Table A.3.2-1 Fixed Reference Channel for Receiver Requirements (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		9	9	9	9	9	9
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	1320	2216	4392	6712	8760
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	152	872	1800	4392	6712	8760
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	1	1	1	2	2
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	1	1	1	1	2	2
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	3780	6300	13800	20700	27600
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	528	2940	5460	12960	19860	26760
Max. Throughput averaged over 1 frame	kbps	341.6	1143.	1952.	3952.	6040.	7884
<u> </u>	-		2	8	8	8	
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 2:

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to Note 3: each Code Block (otherwise L = 0 Bit)

Table A.3.2-1a Fixed Reference Channel for Receiver Requirements (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	14	14	14	14	14
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		9	9	9	9	9	9
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	1000	1000	1000	1000	1000
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	152	840	840	904	904	904
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	1	1	1	1	1
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	1	1	1	1	1	1
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	3528	3528	3864	3864	3864
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	528	2688	2688	3024	3024	3024
Max. Throughput averaged over 1 frame	kbps	341.6	884	884	890.4	890.4	890.4
UE DL Category		0	0	0	0	0	0

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz
- Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211.
- Note 3: For Sub-Frame 0, it is assumed the 6PRBs are allocated in the centre of the channel where some REs of the same PRBs are occupied by PBCH and synchronization signals.
- Note 4: For HD-FDD UE, the downlink subframes are scheduled at the 0th, 1st, 2nd, 8th, 9th, 10th, 16th, 17th, 18th, 24th, 25th, 26th, 32nd, 33rd, 34th subframes every 40ms. Information bit payload is available if downlink subframe is scheduled.

Table A.3.2-1b Fixed Reference Channel for Receiver Requirements (FDD and HD-FDD) – for CAT-M1

Parameter	Unit	Value					
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		4	4	4	4	4	4
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		2	2	8	8	8	8
(Note 6)							
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 3,8	Bits	256	256	256	328	328	328
For Sub-Frames 0,1,2,5,7,9	Bits	N/A	N/A	256	328	328	328
For Sub-Frame 4	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 6	Bits	N/A	N/A	N/A	N/A	N/A	N/A
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
For Sub-Frames 3,8	Bits	1	1	1	1	1	1
For Sub-Frames 0,1,2,5,7,9	Bits	N/A	N/A	1	1	1	1
For Sub-Frame 4	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 6	Bits	N/A	N/A	N/A	N/A	N/A	N/A
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 3,8	Bits	912	1008	1008	1104	1104	1104
For Sub-Frames 0,1,2,5,7,9	Bits	N/A	N/A	1008	1104	1104	1104
For Sub-Frame 4	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 6	Bits	N/A	N/A	N/A	N/A	N/A	N/A
Max. Throughput averaged over 1 frame	kbps	51.2	51.2	204.8	262.4	262.4	262.4
for FDD							
Max. Throughput averaged over 1 frames	kbps	25.6	25.6	76.8	98.4	98.4	98.4
for HD-FDD							
UE DL Category Note 1: 2 symbols allocated to PDCCH for		M1	M1	M1	M1	M1	M1

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211.

Note 3: The scheduled narrowband other than 1.4MHz and 3MHz channel bandwidth avoids the centre of the channel where some REs of the same PRBs are occupied by PBCH and synchronization signals.

Note 4: For HD-FDD UE, PDSCH are scheduled at the 3rd subframe every 1 radio frame for 1.4MHz and 3MHz channel bandwidth. For other channel bandwidth, PDSCH are scheduled at the 0th, 1st, and 2nd subframes every 1 radio frame. Information bit payload is available if downlink subframe is scheduled. The corresponding MPDCCH is scheduled 2 subframes before the corresponding PDSCH transmission.

Note 5: 2 resource blocks allocated to MPDCCH.

Table A.3.2-1c Fixed Reference Channel for Receiver Requirements (HD-FDD) without repetition – for CAT-NB1

	Parameter	Unit	Value
Channel	bandwidth	MHz	0.2
Number	of subcarriers		12
Modulation	on		QPSK
Target C	oding Rate		1/3
Number	of HARQ Processes	Processes	1
Maximun	n number of HARQ transmissions		1
Transpor	t block size	Bits	88
Number	of Sub-Frames per transport block		1
Transpor	t block CRC	Bits	24
Binary C	hannel Bits Per Sub-Frame	Bits	320
LTE CRS	S port		N/A
Number	of NRS ports		1
	of NPDSCH repetitions		0
UE DL C	ategory		NB1
Note 1:	Category NB1 in stand-alone mode h		
Note 2:	Reference signal, Synchronization sig 36.211.	gnals and NPBCH allocated	as per TS
Note 3:	If more than one Code Block is prese 24 Bits is attached to each Code Block		ence of L =
Note 4:	Parameters related to NPDSCH sche Table A.3.2-1g.		A.3.2-1e to
Note 5:	NPDCCH and information bit payload used for transmission of SI messages		ubframes
Note 6:	SI messages transmission should be	prioritized over NPDCCH tr	
	in case of collision. NPDCCH transm		
	downlink subframe in case NPDCCH		
	downlink subframe, where an NB-IoT		frame that
	does not contain NPSS/NSSS/NPBC	H/SIB1-NB transmission.	

Table A.3.2-1d: Void

Table A.3.2-1e: General configuration for CAT-NB1

Parameter	Unit	Value
NB-IoT downlink subframe		
bitmap for anchor carrier		Not configued
(downlinkBitmap)		
NB-IoT downlink subframe		
bitmap for non-anchor carrier		Not configured
(downlinkBitmapNonAnchor)		
Downlink gap configuration for		Not configured
anchor carrier (dl-Gap)		Not configured
Downlink gap configuration for		
non-anchor carrier		Not configured
(dl-GapNonAnchor)		_

Table A.3.2-1f: NPDCCH configuration for NPDSCH scheduling

Parameter	Unit	Value
DCI format		DCI format N1
NPDCCH format		1
Scheduling delay ($I_{ m Delay}$)		0
DCI subframe repetition number		00
$R_{ m max}$ (npdcch-NumRepetitions)		1
G (NPDCCH-startSF-USS)		8
$lpha_{ m offset}$ (npdcch-Offset-USS)		1/4

Table A.3.2-1g: NPUSCH format 2 configurations for NPDSCH scheduling

Parameter	Unit	Value
Scheduling delay		_
(I _{Delay})		0
$N_{ m Rep}^{\it AN}$ (ack-NACK-		1
NumRepetitions)		·
ACK/NACK resource field		0

Table A.3.2-2 Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit			Va	lue		
Channel Bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3	3+2	3+2	3+2	3+2	3+2
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmission		1	1	1	1	1	1
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Information Bit Payload per Sub-Frame	Bits						
For Sub-Frame 4, 9		408	1320	2216	4392	6712	8760
For Sub-Frame 1, 6		N/A	968	1544	3240	4968	6712
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		208	1064	1800	4392	6712	8760
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frame 4, 9		1	1	1	1	2	2
For Sub-Frame 1, 6		N/A	1	1	1	1	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	1	1	2	2
Binary Channel Bits Per Sub-Frame	Bits						
For Sub-Frame 4, 9		1368	3780	6300	13800	20700	27600
For Sub-Frame 1, 6		N/A	3276	5556	11256	16956	22656
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		672	3084	5604	13104	20004	26904
Max. Throughput averaged over 1 frame	kbps	102.4	564	932	1965.	3007.	3970.
					6	2	4
UE Category	<u> </u>	≥ 1	≥1	≥ 1	≥ 1	≥ 1	≥ 1

For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz Note 1: channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs. For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with

Note 2: insufficient PDCCH performance

Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4] Note 3:

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to Note 4: each Code Block (otherwise L = 0 Bit).

Note 5: As per Table 4.2-2 in TS 36.211 [4]

Table A.3.2-2a Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit			Va	lue		
Channel Bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	14	14	14	14	14
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3	3+2	3+2	3+2	3+2	3+2
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmission		1	1	1	1	1	1
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Information Bit Payload per Sub-Frame	Bits						
For Sub-Frame 4, 9		408	1000	1000	1000	1000	1000
For Sub-Frame 1, 6		N/A	872	872	872	872	872
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		208	1000	1000	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frame 4, 9		1	1	1	1	1	1
For Sub-Frame 1, 6		N/A	1	1	1	1	1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	1	1	1	1
Binary Channel Bits Per Sub-Frame	Bits						
For Sub-Frame 4, 9		1368	3528	3528	3864	3864	3864
For Sub-Frame 1, 6		N/A	3048	3048	3048	3048	3048
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		672	2832	2832	3168	3168	3168
Max. Throughput averaged over 1 frame	kbps	102.4	474.4	474.4	474.4	474.4	474.4
UE DL Category		0	0	0	0	0	0

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4]

Table A.3.2-2b Fixed Reference Channel for Receiver Requirements (TDD) - for CAT-M1

Parameter	Unit			Va	lue		
Channel Bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		4	4	4	4	4	4
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame (D)		3	3	3	3	3	3
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmission		1	1	1	1	1	1
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target coding rate		1/3	1/3	1/3	1/3	1/3	1/3
Information Bit Payload per Sub-Frame	Bits						
For Sub-Frame 4, 9		256	256	256	328	328	328
For Sub-Frame 1, 6		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		256	256	256	328	328	328
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frame 4, 9		1	1	1	1	1	1
For Sub-Frame 1, 6		N/A	1	1	1	1	1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	1	1	1	1
Binary Channel Bits Per Sub-Frame	Bits						
For Sub-Frame 4, 9		912	1008	1008	1104	1104	1104
For Sub-Frame 1, 6		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		912	1008	1008	1104	1104	1104
Max. Throughput averaged over 1 frame	kbps	76.8	76.8	76.8	98.4	98.4	98.4
UE DL Category		M1	M1	M1	M1	M1	M1

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: No data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4]
- Note 6: For Sub-Frame 0, the scheduled narrowband avoids the centre of the channel where some REs of the same PRBs are occupied by PBCH and synchronization signals.
- Note 7: 2 resource blocks allocated to MPDCCH

Table A.3.2-2c Fixed Reference Channel for Receiver Requirements (TDD Band 46)

Parameter	Unit	Value
Channel bandwidth	MHz	20
Allocated resource blocks		100
Uplink-Downlink Configuration		N/A
Subcarriers per resource block		12
Allocated subframes per Radio Frame (D)		8
Modulation		QPSK
Target Coding Rate		1/3
Number of HARQ Processes	Processes	N/A
Maximum number of HARQ transmissions		N/A
Information Bit Payload per Sub-Frame		
For Sub-Frames 3,4,6,7,8,9	Bits	8760
For Sub-Frame 1,2	Bits	N/A
For Sub-Frame 0,5	Bits	8760
Transport block CRC	Bits	24
Number of Code Blocks per Sub-Frame		
(Note 3)		
For Sub-Frames 3,4,6,7,8,9	Bits	2
For Sub-Frame 1,2	Bits	N/A
For Sub-Frame 0,5	Bits	2
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 3,4,6,7,8,9	Bits	27600
For Sub-Frame 1,2	Bits	N/A
For Sub-Frame 0,5	Bits	27312
Max. Throughput averaged over 1 frame	kbps	7008
UE Category		≥ 1

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal and Synchronization signals allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

Table A.3.2-3 Fixed Reference Channel for Maximum input level for UE Categories ≥ 3(FDD)

Parameter	Unit	Value						
Channel bandwidth	MHz	1.4	3	5	10	15	20	
Allocated resource blocks		6	15	25	50	75	100	
Subcarriers per resource block		12	12	12	12	12	12	
Allocated subframes per Radio Frame		8	9	9	9	9	9	
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4	
Number of HARQ Processes	Processes	8	8	8	8	8	8	
Maximum number of HARQ transmissions		1	1	1	1	1	1	
Information Bit Payload per Sub-Frame								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	14112	30576	46888	61664	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	N/A	6456	12576	28336	45352	61664	
Transport block CRC	Bits	24	24	24	24	24	24	
Number of Code Blocks per Sub-Frame (Note 3)								
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	3	5	8	11	
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0		N/A	2	3	5	8	11	
Binary Channel Bits Per Sub-Frame								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	18900	41400	62100	82800	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	
For Sub-Frame 0	Bits	N/A	8820	16380	38880	59580	80280	
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	12547	27294	42046	55498	

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Table A.3.2-3a Fixed Reference Channel for Maximum input level for UE Category 1 (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	18	17	17	17
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	10296	10296	10296	10296
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6456	8248	10296	10296	10296
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	2	2	2	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	2	2	2	2
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	13608	14076	14076	14076
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	8820	11088	14076	14076	14076
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	9079.6	9266.4	9266.4	9266.4

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.2-3b Fixed Reference Channel for Maximum input level for UE Category 2 (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	83
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2984	8504	14112	30576	46888	51024
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6456	12576	28336	45352	51024
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	3	5	8	9
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	5	8	9
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4104	11340	18900	41400	62100	68724
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	8820	16380	38880	59580	66204
Max. Throughput averaged over 1 frame	kbps	2387.2	7448.8	12547	27294	42046	45922

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.
- Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.2-3c Fixed Reference Channel for Maximum input level for UE DL Category 0 (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		2	2	2	2	2	2
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1000	1000	1000	1000	1000	1000
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	N/A	1000	1000	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9		1	1	1	1	1	1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	1	1	1	1	1
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	1512	1512	1656	1656	1656
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0 (Note 3)	Bits	N/A	1512	1512	1656	1656	1656
Max. Throughput averaged over 1 frame	kbps	800	900	900	900	900	900

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211.

Note 3: For Sub-Frame 0, it is assumed that the allocated 2PRBs are scheduled on the RBs other than the center 6PRBs as most of the symbols are occupied by PBCH and synchronization signals.

Table A.3.2-3d Fixed Reference Channel for Maximum input level for UE DL Category M1 (FDD and HD-FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		2	2	2	2	2	2
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		2	2	8	8	8	8
(Note 6)							
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding Rate		3/5	3/5	3/5	3/5	3/5	3/5
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload							
For Sub-Frames 3,8	Bits	552	552	552	552	552	552
For Sub-Frames 0,1,2,5,7,9	Bits	N/A	N/A	552	552	552	552
For Sub-Frame 4	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 6	Bits	N/A	N/A	N/A	N/A	N/A	N/A
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
For Sub-Frames 3,8		1	1	1	1	1	1
For Sub-Frames 0,1,2,5,7,9		N/A	N/A	1	1	1	1
For Sub-Frame 4		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 6		N/A	N/A	N/A	N/A	N/A	N/A
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 3,8	Bits	912	1008	1008	1008	1008	1008
For Sub-Frames 0,1,2,5,7,9		N/A	N/A	1008	1008	1008	1008
For Sub-Frame 4	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 6	Bits	N/A	N/A	N/A	N/A	N/A	N/A
Max. Throughput averaged over 1 frame for FDD	kbps	110.4	110.4	441.6	441.6	441.6	441.6
Max. Throughput averaged over 1 frame for HD-FDD		55.2	55.2	165.6	165.6	165.6	165.6

- Note 1: 4 symbols allocated to PDCCH for 1.4MHz channel bandwidth. 3 symbols allocated to PDCCH for all other channel bandwidths.
- Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211.
- Note 3: The scheduled narrowband other than 1.4MHz and 3MHz channel bandwidth avoids the centre of the channel where some REs of the same PRBs are occupied by PBCH and synchronization signals.
- Note 4: For HD-FDD UE, PDSCH are scheduled at the 3rd subframe every 1 radio frame for 1.4MHz and 3MHz channel bandwidth. For other channel bandwidth, PDSCH are scheduled at the 0th, 1st, and 2nd subframes every 1 radio frame. Information bit payload is available if downlink subframe is scheduled. The corresponding MPDCCH is scheduled 2 subframes before the corresponding PDSCH transmission.
- Note 5: 2 resource blocks allocated to MPDCCH.

Table A.3.2-4 Fixed Reference Channel for Maximum input level for UE Categories ≥ 3 (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	2984	8504	14112	30576	46888	61664
For Sub-Frames 1,6	Bits	N/A	6968	11448	23688	35160	46888
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6968	12576	30576	45352	61664
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	2	3	5	8	11
For Sub-Frames 1,6		N/A	2	2	4	6	8
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	5	8	11
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	4104	11340	18900	41400	62100	82800
For Sub-Frames 1,6		N/A	9828	16668	33768	50868	67968
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	9252	16812	39312	60012	80712
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	6369.6	13910	20945	27877

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4a Fixed Reference Channel for Maximum input level for UE Category 1 (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	18	17	17	17
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	2984	8504	10296	10296	10296	10296
For Sub-Frames 1,6	Bits	N/A	6968	8248	7480	7480	7480
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6968	8248	10296	10296	10296
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	2	2	2	2	2
For Sub-Frames 1,6		N/A	2	2	2	2	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	2	2	2	2
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	4104	11340	13608	14076	14076	14076
For Sub-Frames 1,6		N/A	9828	11880	11628	11628	11628
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	9252	11520	14076	14076	14076
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	4533.6	4584.8	4584.8	4584.8

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4b Fixed Reference Channel for Maximum input level for UE Category 2 (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	83
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	2984	8504	14112	30576	46888	51024
For Sub-Frames 1,6	Bits	N/A	6968	11448	23688	35160	39232
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	6968	12576	30576	45352	51024
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	2	3	5	8	9
For Sub-Frames 1,6		N/A	2	3	5	7	7
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	5	8	9
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	4104	11340	18900	41400	62100	68724
For Sub-Frames 1,6		N/A	9828	16668	33768	50868	56340
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	9252	16380	39312	60012	66636
Max. Throughput averaged over 1 frame	kbps	596.8	3791.2	6369.6	13910	20945	23154

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4c Fixed Reference Channel for Maximum input level for UE DL Category 0 (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		2	2	2	2	2	2
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	1000	1000	1000	1000	1000	1000
For Sub-Frames 1,6	Bits	N/A	712	712	712	712	712
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	1000	1000	1000	1000	1000
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	1	1	1	1	1
For Sub-Frames 1,6		N/A	1	1	1	1	1
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	1	1	1	1	1
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	1368	1512	1512	1656	1656	1656
For Sub-Frames 1,6		N/A	1224	1224	1368	1368	1368
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	1512	1512	1656	1656	1656
Max. Throughput averaged over 1 frame	kbps	200	442.4	442.4	442.4	442.4	442.4

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-4d Fixed Reference Channel for Maximum input level for UE Categories ≥ 3 (TDD Band 46)

Parameter	Unit	Value					
Channel bandwidth	MHz	20					
Allocated resource blocks		100					
Uplink-Downlink Configuration		N/A					
Subcarriers per resource block		12					
Allocated subframes per Radio Fram	ne (D)	8					
Modulation		64QAM					
Target Coding Rate		3/4					
Number of HARQ Processes	Processes	N/A					
Maximum number of HARQ transmis	ssions	N/A					
Information Bit Payload per Sub-Frai	me						
For Sub-Frames 3,4,6,7,8,9	Bits	61664					
For Sub-Frame 1,2	Bits	N/A					
For Sub-Frame 0,5	Bits	61664					
Transport block CRC	Bits	24					
Number of Code Blocks per Sub-Fra	me						
(Note 3)							
For Sub-Frames 3,4,6,7,8,9		11					
For Sub-Frame 1,2		N/A					
For Sub-Frame 0,5		11					
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 3,4,6,7,8,9	Bits	82800					
For Sub-Frame 1,2	Bits	N/A					
For Sub-Frame 0,5	Bits	81936					
Max. Throughput averaged over 1 fra	ame kbps	49331.2					
Note 1: 2 symbols allocated to PD	OCCH for 20 MHz.						
Note 2: Reference signal, Synchronization signals allocated as per TS 36.211 [4].							
Note 3: If more than one Code Blo	ock is present, an addit	tional CRC					

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.2-4e Fixed Reference Channel for Maximum input level for UE DL Category M1 (TDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		2	2	2	2	2	2
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	2	2	2	2	2
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding Rate		3/5	3/5	3/5	3/5	3/5	3/5
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	552	552	552	552	552	552
For Sub-Frames 1,6	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A	N/A	N/A	N/A	N/A
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	1	1	1	1	1
For Sub-Frames 1,6		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	N/A	N/A	N/A	N/A	N/A
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	912	1008	1008	1008	1008	1008
For Sub-Frames 1,6		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A	N/A	N/A	N/A	N/A
Max. Throughput averaged over 1 frame	kbps	110.4	110.4	110.4	110.4	110.4	110.4

- For normal subframes(0,4,5,9), 4 symbols allocated to PDCCH for 1.4MHz channel bandwidth and 3 symbols Note 1: allocated to PDCCH for all other channel bandwidths. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH
- Note 3:
- Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]. If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Note 4: Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].
- 2 resource blocks allocated to MPDCCH Note 6:

Table A.3.2-5 Fixed Reference Channel for Maximum input level for UE Categories 11/12 and UE DL categories ≥ 11 (FDD)

Parameter	Unit			Va	lue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Subcarriers per resource block		12	12	12	12	12	12
Allocated subframes per Radio Frame		8	9	9	9	9	9
Modulation		256QAM	256QAM	256QAM	256QAM	256QAM	256QAM
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5
Number of HARQ Processes	Processes	8	8	8	8	8	8
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	4392	12216	19848	42368	63776	84760
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	9912	17568	40576	63776	84760
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	4	7	11	14
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	7	11	14
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	5472	15120	25200	55200	82800	110400
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	12210	22290	51840	79440	107040
Max. Throughput averaged over 1 frame	kbps	3513.6	10764	17635.2	37952	57398.4	76284

² symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz. Note 1:

Note 2:

Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Note 3: Block (otherwise L = 0 Bit).

Table A.3.2-6 Fixed Reference Channel for Maximum input level for UE Categories 11/12 and UE DL categories ≥ 11 (TDD)

Parameter	Unit			V	alue		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6	15	25	50	75	100
Subcarriers per resource block		12	12	12	12	12	12
Uplink-Downlink Configuration (Note 5)		1	1	1	1	1	1
Allocated subframes per Radio Frame		2	3+2	3+2	3+2	3+2	3+2
Modulation		256QAM	256QAM	256QAM	256QAM	256QAM	256QAM
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5
Number of HARQ Processes	Processes	7	7	7	7	7	7
Maximum number of HARQ transmissions		1	1	1	1	1	1
Information Bit Payload per Sub-Frame							
For Sub-Frames 4,9	Bits	4392	12216	19848	42368	63776	84760
For Sub-Frames 1,6	Bits	N/A	10680	17568	36696	55056	75376
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	9912	17568	42368	63776	84760
Transport block CRC	Bits	24	24	24	24	24	24
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9		1	2	4	7	11	14
For Sub-Frames 1,6		N/A	2	3	6	9	13
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		N/A	2	3	7	11	14
Binary Channel Bits per Sub-Frame							
For Sub-Frames 4,9	Bits	5472	15120	25200	55200	82800	110400
For Sub-Frames 1,6		N/A	13104	22224	45024	67824	90624
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	N/A	12336	22416	52416	80016	107616
Max. Throughput averaged over 1 frame	kbps	878.4	5570.4	9240	20049.6	30144	40503.2

- Note 1: For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- Note 2: For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with insufficient PDCCH performance.
- Note 3: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: As per Table 4.2-2 in TS 36.211 [4].

Table A.3.2-7 Fixed Reference Channel for Maximum input level for UE Categories 11/12 and UE DL categories ≥ 11 (TDD Band 46)

Parameter	Unit	Value					
Channel bandwidth	MHz	20					
Allocated resource blocks		100					
Uplink-Downlink Configuration		N/A					
Subcarriers per resource block		12					
Allocated subframes per Radio Frame (D)		8					
Modulation		256QAM					
Target Coding Rate		4/5					
Number of HARQ Processes	Processes	N/A					
Maximum number of HARQ transmissions		N/A					
Information Bit Payload per Sub-Frame							
For Sub-Frames 3,4,6,7,8,9	Bits	84760					
For Sub-Frame 1,2	Bits	N/A					
For Sub-Frame 0,5	Bits	84760					
Transport block CRC	Bits	24					
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 3,4,6,7,8,9		14					
For Sub-Frame 1,2		N/A					
For Sub-Frame 0,5		14					
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 3,4,6,7,8,9	Bits	110400					
For Sub-Frame 1,2	Bits	N/A					
For Sub-Frame 0,5	Bits	109248					
Max. Throughput averaged over 1 frame	kbps	67808					
Note 1: 2 symbols allocated to PDCCH for							
Note 2: Reference signal, Synchronization signals allocated as per TS 36.211 [4].							
Note 3: If more than one Code Block is pre							
sequence of L = 24 Bits is attache (otherwise L = 0 Bit).	d to each Cod	le Block					

A.3.3 Reference measurement channels for PDSCH performance requirements (FDD)

A.3.3.1 Single-antenna transmission (Common Reference Symbols)

Table A.3.3.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	Unit	Value							
Reference channel		R.4	R.42	R.42-1	R.42-2	R.42-3	R.2		
		FDD	FDD	FDD	FDD	FDD	FDD		
Channel bandwidth	MHz	1.4	20	3	5	15	10		
Allocated resource blocks (Note 4)		6	100	15	25	75	50		
Allocated subframes per Radio Frame		9	9	9	9	9	9		
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK		
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3		
Information Bit Payload (Note 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	408	8760	1320	2216	6712	4392		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	152	8760	1064	1800	6712	4392		
Number of Code Blocks									
(Notes 3 and 4)									
For Sub-Frames 1,2,3,4,6,7,8,9		1	2	1	1	2	1		
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0		1	2	1	1	2	1		
Binary Channel Bits (Note 4)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1368	27600	3780	6300	20700	13800		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	528	26760	2940	5460	19860	12960		
Max. Throughput averaged over 1 frame	Mbps	0.342	7.884	1.162	1.953	6.041	3.953		
(Note 4)									
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Given per component carrier per codeword.

Table A.3.3.1-2: Fixed Reference Channel 16QAM R=1/2

Parameter	Unit			V	'alue		
Reference channel				R.3-1 FDD	R.3 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Allocated subframes per Radio Frame				9	9		
Modulation				16QAM	16QAM		
Target Coding Rate				1/2	1/2		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			6456	14112		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			5736	12960		
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9				2	3		
For Sub-Frame 5				N/A	N/A		
For Sub-Frame 0				1	3		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits			12600	27600		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			10920	25920		
Max. Throughput averaged over 1 frame	Mbps			5.738	12.586		
UE Category				≥ 1	≥2		_

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-3: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit			Va	lue		
Reference channel			R.5	R.6	R.7	R.8	R.9 FDD
			FDD	FDD	FDD	FDD	
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks			15	25	50	75	100
Allocated subframes per Radio Frame			9	9	9	9	9
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		8504	14112	30576	46888	61664
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		6456	12576	28336	45352	61664
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9			2	3	5	8	11
For Sub-Frame 5			N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0			2	3	5	8	11
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		11340	18900	41400	62100	82800
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		8820	16380	38880	59580	80280
Max. Throughput averaged over 1 frame	Mbps		7.449	12.547	27.294	42.046	55.498
UE Category			≥ 1	≥ 2	≥ 2	≥ 2	≥ 3

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-3a: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit	Value
Reference channel		R.6-1 R.7-1 R.8-1 R.9-1 R.9-2
		FDD FDD FDD FDD FDD
Channel bandwidth	MHz	5 10 15 20 20
Allocated resource blocks (Note 3)		18 17 17 17 83
Allocated subframes per Radio Frame		9 9 9 9
Modulation		64QAM 64QAM 64QAM 64QAM 64QAM
Target Coding Rate		3/4 3/4 3/4 3/4 3/4
Information Bit Payload		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10296 10296 10296 10296 51024
For Sub-Frame 5	Bits	N/A N/A N/A N/A N/A
For Sub-Frame 0	Bits	8248 10296 10296 10296 51024
Number of Code Blocks per Sub-Frame		
(Note 4)		
For Sub-Frames 1,2,3,4,6,7,8,9		2 2 2 9
For Sub-Frame 5		N/A N/A N/A N/A N/A
For Sub-Frame 0		2 2 2 9
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	13608 14076 14076 14076 68724
For Sub-Frame 5	Bits	N/A N/A N/A N/A N/A
For Sub-Frame 0	Bits	11088 14076 14076 14076 66204
Max. Throughput averaged over 1 frame	Mbps	9.062 9.266 9.266 9.266 45.922
UE Category		≥1 ≥1 ≥1 ≥1 ≥2

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: Localized allocation started from RB #0 is applied.
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-4: Fixed Reference Channel Single PRB (Channel Edge)

Parameter	Unit			Val	ue		
Reference channel			R.0 FDD		R.1 FDD		
Channel bandwidth	MHz	1.4	3	5	10/20	15	20
Allocated resource blocks			1		1		
Allocated subframes per Radio Frame			9		9		
Modulation			16QAM		16QAM		
Target Coding Rate			1/2		1/2		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		224		256		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		224		256		
Number of Code Blocks per Sub-Frame (Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9			1		1		
For Sub-Frame 5			N/A		N/A		
For Sub-Frame 0			1		1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits		504		552		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		504		552		
Max. Throughput averaged over 1 frame	Mbps		0.202		0.230		
UE Category			≥ 1	•	≥ 1	•	

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Unit	Value						
Reference channel		R.29 FDD						
		(MBSFN)						
Channel bandwidth	MHz	10						
Allocated resource blocks		1						
MBSFN Configuration (Note 4)		111111						
Allocated subframes per Radio Frame		3						
Modulation		16QAM						
Target Coding Rate		1/2						
Information Bit Payload								
For Sub-Frames 4,9	Bits	256						
For Sub-Frame 5	Bits	N/A						
For Sub-Frame 0	Bits	256						
For Sub-Frame 1,2,3,6,7,8	Bits	0 (MBSFN)						
Number of Code Blocks per Sub-Frame								
(Note 3)								
For Sub-Frames 4,9		1						
For Sub-Frame 5		N/A						
For Sub-Frame 0		1						
For Sub-Frame 1,2,3,6,7,8		0 (MBSFN)						
Binary Channel Bits Per Sub-Frame								
For Sub-Frames 4,9	Bits	552						
For Sub-Frame 5	Bits	N/A						
For Sub-Frame 0	Bits	552						
For Sub-Frame 1,2,3,6,7,8	Bits	0 (MBSFN)						
Max. Throughput averaged over 1 frame	kbps	76.8						
UE Category		≥ 1						
Note 1: 2 symbols allocated to PDCCH.								
Note 2: Reference signal, synchronizat		and PBCH						
allocated as per TS 36.211 [4].								
Note 3: If more than one Code Block is present, an additional								
CRC sequence of L = 24 Rits is attached to each Code								

CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation

Note 4:

Table A.3.3.1-6: Fixed Reference Channel QPSK R=1/10

Parameter	Unit			V	alue		
Reference channel					R.41 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Allocated subframes per Radio Frame					9		
Modulation					QPSK		
Target Coding Rate					1/10		
Information Bit Payload							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits				1384		
For Sub-Frame 5	Bits				N/A		
For Sub-Frame 0	Bits				1384		
Number of Code Blocks per Sub-Frame							
(Note 3)							
For Sub-Frames 1,2,3,4,6,7,8,9					1		
For Sub-Frame 5					N/A		
For Sub-Frame 0					1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 1,2,3,4,6,7,8,9	Bits				13800		
For Sub-Frame 5	Bits				N/A		
For Sub-Frame 0	Bits				12960		
Max. Throughput averaged over 1 frame	Mbps				1.246		
UE Category					≥1		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.3.1-7: Fixed Reference Channel for CA demodulation with power imbalance

Parameter	Unit		Value	
Reference channel		R.49 FDD	R.49-1 FDD	R.49-2 FDD
Channel bandwidth	MHz	20	10	5
Allocated resource blocks		100	50	25
Allocated subframes per Radio Frame		9	9	9
Modulation		64QAM	64QAM	64QAM
Coding Rate				
For Sub-Frame 1,2,3,4,6,7,8,9,		0.84	0.84	0.84
For Sub-Frame 5		N/A	N/A	N/A
For Sub-Frame 0		0.87	0.87	0.86
Information Bit Payload				
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	63776	31704	15840
For Sub-Frame 5	Bits	N/A	N/A	N/A
For Sub-Frame 0		63776	30576	14112
Number of Code Blocks per Sub-Frame (Note 3)				
For Sub-Frames 0,1,2,3,4,6,7,8,9	Code	11	6	3
	Blocks			
For Sub-Frame 5	Code Blocks	N/A	N/A	N/A
Binary Channel Bits Per Sub-Frame			5	3
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	75600		
For Sub-Frame 5	Bits	N/A	37800	18900
For Sub-Frame 0	Bits	73080	N/A	N/A
Max. Throughput averaged over 1 frame	Mbps	57.398	35280	16380
UE Category		≥5	≥2	≥2

Note 1: 3 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]. Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is

attached to each Code Block (otherwise L = 0 Bit).

A.3.3.2 Multi-antenna transmission (Common Reference Symbols)

A.3.3.2.1 Two antenna ports

Table A.3.3.2.1-1: Fixed Reference Channel two antenna ports

Parameter	Unit						Va	lue					
Reference		R.10	R.11	R.11-	R.11-	R.11-	R.11-	R.30	R.30-	R.35-	R.35	R.35-	R.35-
channel		FDD	FDD	1 FDD	2 FDD	3 FDD Note 5	4 FDD	FDD	1 FDD	1 FDD	FDD	2 FDD	3 FDD
Channel	MHz	10	10	10	5	10	10	20	15	20	10	15	10
bandwidth	IVIHZ												
Allocated resource blocks (Note 4)		50	50	50	25	40	50	100	75	100	50	75	50
Allocated subframes per Radio Frame		9	9	8	9	9	9	9	8	8	9	8	8
Modulation		QPSK	16QA M	16QA M	16QA M	16QA M	QPSK	16QA M	16QA M	64QA M	64QA M	64QA M	64QA
Target Coding Rate		1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.39	1/2	0.39	0.39
Information Bit Payload (Note 4)													
For Sub- Frames 1,2,3,4,6,7,8,9	Bits	4392	12960	12960	5736	10296	6968	25456	19080	30576	19848	22920	15264
For Sub-Frame	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame	Bits	4392	12960	N/A	4968	10296	6968	25456	N/A	N/A	18336	N/A	N/A
Number of Code Blocks (Notes 3 and 4)													
For Sub- Frames 1,2,3,4,6,7,8,9	Bits	1	3	3	1	2	2	5	4	5	4	4	3
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame	Bits	1	3	N/A	1	2	2	5	N/A	N/A	3	N/A	N/A
Binary Channel Bits (Note 4)													
For Sub- Frames 1,2,3,4,6,7,8,9	Bits	13200	26400	26400	12000	21120	13200	52800	39600	79200	39600	59400	39600
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	12384	24768	N/A	10368	19488	12384	51168	N/A	N/A	37152	N/A	N/A
Max. Throughput averaged over 1 frame (Note 4)	Mbps	3.953	11.66 4	10.36 8	5.086	9.266	6.271	22.91 0	15.26 4	24.46 1	17.71 2	18.33 6	12.21 1
UE Category		≥ 1	≥ 2	≥ 2	≥ 1	≥ 1	≥ 1	≥ 2	≥ 2	4	≥ 2	≥ 2	≥ 2

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Given per component carrier per codeword.

Note 5: For R.11-3 resource blocks of RB6-RB45 are allocated.

Table A.3.3.2.1-2: Fixed Reference Channel two antenna ports

Parameter	Unit						Val	ue					
Reference channel		R.46	R.47	R.35-4	R.11-5	R.11-6	R.11-7	R.11-8	R.11-	R.11-	R.65	R.10-	R.10-
		FDD	FDD	FDD	FDD	FDD	FDD	FDD	9 FDD	10	FDD	2 FDD	3 FDD
										FDD			
Channel bandwidth	MHz	10	10	10	1.4	3	15	10	10	10	10	5	10
Allocated resource blocks (Note 4)		50	50	50	6	15	75	50	50	50	50	25	50
Allocated number of PDCCH symbols		2	2	2	4	3	2	2	3	3	2	3	2
Allocated subframes per Radio Frame		9	9	9	8	9	9	9	8	8	8	9	9
Modulation		QPSK	16QA	64QA	16QA	16QA	16QA	QPSK	QPSK	QPSK	256QA	QPSK	16QA
			M	M	M	М	M				M		M
Target Coding Rate				0.47	1/2	1/2	1/2	3/5	0.58	0.67	0. 55	1/3	0.58
Information Bit Payload (Note 4)													
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	5160	8760	18336	1352	3368	19080	7992	6968	7992	31704	1800	15264
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	n/a	n/a
For Sub-Frame 0	Bits	5160	8760	16416	N/A	2664	19080	6968	N/A	N/A	N/A	1800	14112
Number of Code Blocks													
(Notes 3 and 4)													
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1	2	3	1	1	4	2	2	2	6	1	3
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	n/a	n/a
For Sub-Frame 0	Bits	1	2	3	1	1	4	2	N/A	N/A	N/A	1	3
Binary Channel Bits (Note 4)													
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	13200	26400	39600	2592	7200	39600	13200	12000	12000	57600	6000	26400
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	n/a	n/a
For Sub-Frame 0	Bits	12384	24768	37152	N/A	5568	37968	12384	N/A	N/A	N/A	5184	24768
Max. Throughput averaged over 1	Mbps	4.644	7.884	16.310	1.082	2.961	17.172	7.0904	5.5744	6.3936	25.363	1.620	13.62
frame (Note 4)	,												24
UE Category		≥ 1	≥ 1	≥2	≥ 1	≥ 1	≥ 2	≥2	≥ 1	≥ 1	11-12	≥ 1	≥ 2
UE DL Category		≥ 6	≥ 6	≥ 6	≥ 6	≥ 6	≥ 6	≥ 6			≥ 11	≥ 6	

Note 1: Void

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 4: Given per component carrier per codeword.

Table A.3.3.2.1-3: Fixed Reference Channel two antenna ports

Parameter	Unit	Va	lue				
Reference channel		R.62	R.63				
		FDD	FDD				
Channel bandwidth	MHz	10	10				
Allocated resource blocks (Note 4)		3	1				
Allocated DL subframes per 4 Radio Frames (Note 3)		15	15				
Modulation		16QAM	64QAM				
Target Coding Rate		1/2	1/2				
Information Bit Payload							
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	744	408				
Number of Code Blocks							
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Code blocks	1	1				
Binary Channel Bits							
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	1584	792				
Max. Throughput averaged over 4 frames	Mbps	0.279	0.153				
UE DL Category		0	0				
Note 1: 2 symbols allocated to PDCCH							
Note 2: Reference signal, synchronization s	ignals and	PBCH allo	cated as				

lote 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: The downlink subframes are scheduled at the 0th, 1st, 2nd, 8th, 9th, 10th, 16th, 17th, 18th, 24th, 25th, 26th, 32nd, 33rd, 34th subframes every 40ms. Information bit payload is available if downlink subframe is scheduled.

Note 4: Allocated PRB positions start from {9, 10, ..., 9+N-1}, where N is the number of allocated resource blocks.

Table A.3.3.2.1-4: Fixed Reference Channel two antenna ports

Parameter	Unit	Values
Reference channel		R.79 FDD
Channel bandwidth	MHz	10
Allocated resource blocks (Note 4)		3
Allocated DL subframes per Radio Frame (Note 3)		2
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	744
Number of Code Blocks		
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Code blocks	1
Binary Channel Bits		
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	1584
Max. Throughput averaged over 1 frame	Mbps	0.149
UE DL Category		M1, ≥ 0

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: The downlink subframes are scheduled at the 0th and 1st subframes every 10ms. Information bit payload is available if downlink subframe is scheduled (starting from 0th subframe). The corresponding MPDCCH is scheduled 2 subframes before the corresponding PDSCH transmissions.

Note 4: Allocated PRB positions for PDSCH are {3, 4, 5} within the assigned narrowband. Allocated PRB positions for MPDCCH are {0, 1} within the assigned narrowband.

Table A.3.3.2.1-5: Fixed Reference Channel two antenna ports

Parameter	Unit		Values	
Reference channel		R.81 FDD	R.81-1	R.81-2
			FDD	FDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks (Note 4)		6	6	6
Allocated PDSCH subframes (Note 3)		(Note 3)	(Note 6)	(Note 7)
Modulation		QPSK	QPSK	QPSK
Target Coding Rate		1/10	1/10	1/10
Information Bit Payload				
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	152	152	152
Number of Code Blocks				
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Code	1	1	1
	blocks			
Binary Channel Bits				
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	1584	1584	1584
Max. Throughput averaged over one period	kbps	0.950	1.9	4.75
UE DL Category		M1, ≥ 0	≥1	≥1

- 2 symbols allocated to PDCCH Note 1:
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 3: PDSCH subframes are scheduled at the 65th to 128th subframes every period=160 ms. Information bit payload is available at the 65th to 128th subframes with repetition. (Starting from the 0th subframe)
- Allocated PRB positions are {0, 1, 2, 3, 4, 5} within the assigned narrowband. Note 4:
- MPDCCH are scheduled at the 0th to 63rd subframes with repetition. The allocated PRB positions are {0, Note 5: 1, 2, 3, 4, 5} within the assigned narrowband. (Starting from the 0th subframe) PDSCH subframes are scheduled at the 33th to 64th subframes every period=80 ms. Information bit
- Note 6: payload is available at the 33th to 64th subframes with repetition. (Starting from the 0th subframe)
- Note 7: PDSCH subframes are scheduled at the 9th to 24th subframes every period=32 ms. Information bit payload is available at the 9th to 24th subframes with repetition. (Starting from the 0th subframe)

A.3.3.2.2 Four antenna ports

Table A.3.3.2.2-1: Fixed Reference Channel four antenna ports

Parameter	Unit								Value						
Reference channel		R.12	R.13	R.14	R.14-	R.14-	R.14-	R.36	R.14-	R.14-	R.14-	R.14-	R.72	R.73	R.74
		FDD	FDD	FDD	1	2	3	FDD	4	5	6	7	FDD	FDD	FDD
					FDD	FDD	FDD		FDD	FDD	FDD	FDD			
Channel bandwidth	MHz	1.4	10	10	10	10	20	10	1.4	3	5	15	10	10	10
Allocated resource		6	50	50	6	3	100	50	6	15	25	75	50	50	50
blocks (Note 4)															
Allocated subframes		9	9	9	8	8	9	9	8	9	9	9	9	9	9
per Radio Frame															
Modulation		QPS	QPS	16Q	16QA	16QA	16QA	64Q	16QA	16QA	16QA	16QA	256Q	64QAM	16QA
		K	K	AM	М	М	M	AM	M	M	M	M	AM		M
Target Coding Rate		1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.62	0.43	1/2
Information Bit Payload															
(Note 4)															
For Sub-Frames	Bits	408	4392	1296	1544	744	25456	1833	1192	3368	5736	19080	31704	16416	25456
1,2,3,4,6,7,8,9				0				6						(CW0)	
														32856	
														(CW1)	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	n/a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	152	3624	1144	N/A	N/A	22920	1833	N/A	2664	4968	19080	31704	15264	22920
				8				6						(CW0)	
														30576	
														(CW1)	
Number of Code															
Blocks															
(Notes 3 and 4)								_					_	- (-1111	_
For Sub-Frames		1	1	3	1	1	5	3	1	1	1	4	3	3 (CW0)	5
1,2,3,4,6,7,8,9							,							6 (CW1)	
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	n/a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	2	N/A	N/A	4	3	N/A	1	1	4	3	3 (CW0)	5
														5 (CW1)	
Binary Channel Bits															
(Note 4)						. = = =									
For Sub-Frames	Bits	1248	1280	2560	3072	1536	51200	3840	2496	6960	11600	38400	51200	38400	51200
1,2,3,4,6,7,8,9			0	0				0						(CW0)	
														76800	
	D.:	N 1/2	N1/2	N 1/2	N 1/2			N 1/2	.	N./.	.	.	A1/A	(CW1)	N1/2
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	n/a	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	480	1203	2406	N/A	N/A	49664	3609	N/A	5424	10064	36864	48128	36096	48128
	l	1	2	4			I	6	l	I		Ì	l	(CW0)	Ì

														72192 (CW1)	
Max. Throughput averaged over 1 frame (Note 4)	Mbp s	0.34 2	3.87 6	11.5 13	1.235	0.595	22.65 6	16.5 02	0.954	2.961	5.086	17.17 2	28.53 4	14.659 (CW0) 29.342 (CW1)	22.65 7
UE Category		≥ 1	≥ 1	≥ 2	≥ 1	≥ 1	≥ 2	≥ 2	≥ 1	≥ 1	≥ 1	≥2	≥ 11	≥ 5	≥ 5

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Given per component carrier per codeword.

A.3.3.3 Reference Measurement Channel for UE-Specific Reference Symbols

A.3.3.3.0 Two antenna ports (no CSI-RS)

The reference measurement channels in Table A.3.3.3.0-1 apply with two CRS antenna ports and without CSI-RS.

Table A.3.3.3.0-1: Fixed Reference Channel without CSI-RS

Parameter	Unit		Value
Reference channel		R.70 FDD	R.71 FDD
Channel bandwidth	MHz	10	10
Allocated resource blocks		50	50
Allocated subframes per Radio		10	10
Frame			
Modulation		QPSK	16QAM
Target Coding Rate		0.65	0.6
Information Bit Payload			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	6968	12960
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A
Number of Code Blocks per Sub-			
Frame			
(Note 4)			
For Sub-Frames 1,2,3,4,6,7,8,9		2	3
For Sub-Frame 5		N/A	N/A
For Sub-Frame 0		N/A	N/A
Binary Channel Bits Per Sub-			
Frame			
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10800	21600
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A
Max. Throughput averaged over 1	Mbps	5.5744	10.368
frame			
UE Category		≥ 1	≥ 2

Note 1: 3 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

The reference measurement channels in Table A.3.3.3.0-2 apply for verifying demodulation performance for UE-specific reference symbols without CSI-RS.

Table A.3.3.3.0-2: Fixed Reference Channel without CSI-RS

Parameter	Unit		Value	
Reference channel		R.80 FDD	R.80-1	R.80-2
			FDD	FDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks (Note 4)		6	6	6
Allocated PDSCH subframes		Note 3	Note 6	Note 7
Modulation		QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3
Information Bit Payload				
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	504	504	504
Number of Code Blocks				
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Code	1	1	1
	blocks			
Binary Channel Bits				
For Sub-Frames 0,1,2,3,4,5,6,7,8,9	Bits	1440	1440	1440
Max. Throughput averaged over one period	kbps	15.75	31.5	50.4
UE DL Category		M1, ≥ 0	≥1	≥1
Note 1: 2 symbols allocated to PDCCH	•	•	•	•

- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]
- PDSCH subframes are scheduled at the 9th to 16th subframes every period=32 ms. Information Note 3: bit payload is availabled from the 9th to 16th subframes with repetition. (Starting from the 0th subframe)
- Note 4: Allocated PRB positions are {0, 1, 2, 3, 4, 5} within the assigned narrowband.
- Note 5: MPDCCH are scheduled at the 0th to 7th subframes with repetition. The allocated PRB positions are {0, 1, 2, 3, 4, 5} within the assigned narrowband. (Starting from the 0th subframe)
- Note 6: PDSCH subframes are scheduled at the 3th to 6th subframes every period=16 ms. Information bit payload is availabled from the 3th to 6th subframes with repetition. (Starting from the 0th subframe)
- PDSCH subframes are scheduled at the 2th to 3th subframes every period=10 ms. Information Note 7: bit payload is availabled from the 2th to 3th subframes with repetition. (Starting from the 0th subframe)

A.3.3.3.1 Two antenna port (CSI-RS)

The reference measurement channels in Table A.3.3.3.1-1 apply for verifying demodulation performance for UEspecific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

Table A.3.3.3.1-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

Parameter	Unit		Value	
Reference channel		R.51 FDD	R.51-1 FDD	R.76 FDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks		50 (Note 3)	50 (Note 3)	50 (Note 3)
Allocated subframes per Radio Frame		9	9	9
Modulation		16QAM	16QAM	QPSK
Target Coding Rate		1/2	0.54	
Information Bit Payload				
For Sub-Frames 1,4,6,9	Bits	11448	12960	6200
For Sub-Frames 2,3,7,8	Bits	11448	12960	6200
For Sub-Frame 5	Bits	N/A	N/A	n/a
For Sub-Frame 0	Bits	9528	10680	4968
Number of Code Blocks (Note 4)				
For Sub-Frames 1,4,6,9	Code	2	3	2
	blocks			
For Sub-Frames 2,3,7,8	Code	2	3	2
	blocks			
For Sub-Frame 5	Bits	N/A	N/A	n/a
For Sub-Frame 0	Bits	2	2	1
Binary Channel Bits				
For Sub-Frames 1,4,6,9	Bits	24000	24000	12000
For Sub-Frames 2,7		23600	23600	11800
For Sub-Frames 3,8		23200	23200	12000
For Sub-Frame 5	Bits	N/A	N/A	n/a
For Sub-Frame 0	Bits	19680	19680	9840
Max. Throughput averaged over 1	Mbps	10.1112	11.436	5.4568
frame				
UE Category		≥ 2	≥ 2	≥2

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks

(RB0-RB20 and RB30-RB49) are allocated in sub-frame 0.

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is

attached to each Code Block (otherwise L = 0 Bit).

The reference measurement channels in Table A3.3.3.1-2 apply for verifying demudlation performance for UE-specific reference symbols with two cell specific antenna ports and two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS in same subframe.

Table A.3.3.3.1-2: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS

Parameter	Unit		Val	ue	
Reference channel		R.52 FDD	R.52-1 FDD	R.53 FDD	R.54 FDD
Channel bandwidth	MHz	10	10	10	10
Allocated resource blocks		50 (Note 3)	50 (Note 3)	50 (Note 3)	50 (Note 3)
Allocated subframes per Radio Frame		9	9	9	9
Modulation		64QAM	16QAM	64QAM	16QAM
Target Coding Rate		1/2	0.54	1/2	1/2
Information Bit Payload					
For Sub-Frames 1,3,4,6,8,9	Bits	18336	12960	18336	11448
For Sub-Frames 2,7	Bits	16416	12960	16416	11448
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	14688	10680	14688	9528
Number of Code Blocks (Note 4)					
For Sub-Frames 1,3,4,6,8,9	Code	3	3	3	2
	blocks				
For Sub-Frames 2, 7	Code	3	3	3	2
	blocks				
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	3	2	3	2
Binary Channel Bits					
For Sub-Frames 1,3,4,6,8,9	Bits	36000	24000	36000	24000
For Sub-Frames 2,7		34200	22800	33600	22800
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a
For Sub-Frame 0	Bits	29520	19680	29520	19680
Max. Throughput averaged over 1	Mbps	15.7536	11.436	15.7536	10.1112
frame					

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

A.3.3.3.2 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.3.3.2-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Parameter	Unit				Value			
Reference channel		R.43	R.43-1	R.43-2	R.50	R.48	R.66	R.75
		FDD						
Channel bandwidth	MHz	10	10	10	10	10	10	10
Allocated resource blocks		50 (Note	50 (Note	50 (Note	50 (Note	50	50 (Note	50
		3)	3)	5)	3)	(Note 3)	3)	(Note 3)
Allocated subframes per Radio		9	9	9	9	9	9	9
Frame								
Modulation		QPSK	QPSK	QPSK	64QAM	QPSK	256QAM	16QAM
Target Coding Rate		1/3	1/3	1/3	1/2		0.77	0.57
Information Bit Payload								
For Sub-Frames 1,4,6,9	Bits	3624	3624	3624	18336	6200	36696	25456
For Sub-Frames 2,3,7,8	Bits	3624	3624	3624	16416	6200	35160	25456
For Sub-Frame 5	Bits	N/A						
For Sub-Frame 0	Bits	2984	2984	3368	14688	4968	30576	21384
Number of Code Blocks (Note								
4)								
For Sub-Frames 1,4,6,9	Code blocks	1	1	1	3	2	6	5
For Sub-Frames 2,3,7,8	Code	1	1	1	3	2	6	5
	blocks					_		
For Sub-Frame 5	Bits	N/A						
For Sub-Frame 0	Bits	1	1	1	3	1	5	4
Binary Channel Bits								
For Sub-Frames 1,6	Bits	12000	13200	13200	36000	12000	48000	43200
For Sub-Frames 4,9	Bits	12000	12000	12000	36000	12000	48000	43200
For Sub-Frames 2,7	Bits	11600	12800	12800	34800	11600	46400	41600
For Sub-Frames 3,8	Bits	11600	12800	12800	34800	12000	46400	41600
For Sub-Frame 5	Bits	N/A						
For Sub-Frame 0	Bits	9840	9840	10560	29520	9840	39360	35424
Max. Throughput averaged	Mbps	3.1976	3.1976	3.236	15.3696	5.4568	31.800	22.503
over 1 frame								
UE Category		≥ 1	≥ 1	≥ 1	≥2	≥ 1	11-12	≥5
UE DL Category		≥ 6	≥ 6	≥ 6	≥ 6	≥ 6	≥ 11	≥ 6

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 47 resource blocks (RB0–RB23 and RB27–RB49) are allocated in sub-frame 0. In sub-frame 0, PDSCH is rate matched around RB22, RB23 and RB27.

The reference measurement channels in Table A.3.3.3.2-2 apply for verifying FDD PMI accuracy measurement and CRI accuracy measurement with two CRS antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-2: Fixed Reference Channel for four antenna ports (CSI-RS)

Parameter	Unit			Value		
Reference channel		R.44	R.45	R.45-1	R.60	R.50A-1
		FDD	FDD	FDD	FDD	FDD
Channel bandwidth	MHz	10	10	10	10	10
Allocated resource blocks		50 ³	50 ³	39	50 ³	50 ³
Allocated subframes per Radio Frame		10	10	10	10	7
Modulation		QPSK	16QAM	16QAM	QPSK	64QAM
Target Coding Rate		1/3	1/2	1/2	1/2	1/2
Information Bit Payload						
For Sub-Frames (Non CSI-RS subframe)	Bits	3624	11448	8760	6200	18336
For Sub-Frames (CSI-RS subframe)	Bits	3624	11448	8760	6200	N/A
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A	N/A	N/A	N/A
subframe)						
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	2984	9528	8760	N/A	14688
Number of Code Blocks per Sub-Frame						
(Note 4)						
For Sub-Frames (Non CSI-RS subframe)		1	2	2	2	3
For Sub-Frames (CSI-RS subframe)		1	2	2	2	N/A
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A	N/A	N/A	N/A
subframe)						
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	2	2	N/A	3
Binary Channel Bits Per Sub-Frame						
For Sub-Frames (Non CSI-RS subframe)	Bits	12000	24000	18720	12000	36000
For Sub-Frames (CSI-RS subframe)	Bits	11600	23200	18096	11600	N/A
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A	N/A	N/A	N/A
subframe)						
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	9840	19680	18720	N/A	29520
Max. Throughput averaged over 1 frame	Mbps	3.1976	10.1112	7.884	4.96	12.4704
UE Category		≥ 1	≥ 2	≥1	≥1	≥ 2

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: For R.44, R.45 and R.60, 50 resource blocks are allocated in sub-frames 1,2,3,4,6,7,8,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.45-1, 39 resource blocks are allocated in all subframes (RB0–RB20 and RB30–RB47). For R.50A-1, 50 resource blocks are allocated in sub-frames 2, 3, 4, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

The reference measurement channels in Table A.3.3.3.2-3 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-3: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

	Parameter	Unit	Value			
Reference	ce channel		R.64			
			FDD			
Channel	bandwidth	MHz	10			
Allocated	d resource blocks (Note 4)		6			
Allocated	d subframes per 4 Radio Frames		15			
Modulati	on		QPSK			
Target C	oding Rate		1/3			
Informati	on Bit Payload					
For Su	b-Frames 0,1,4,5,6,9 (Note 3)	Bits	504			
For Su	b-Frames 2,3,7,8 (Note 3)	Bits	504			
Number	of Code Blocks					
For Su	b-Frames 0,1,4,5,6,9	Code	1			
		blocks				
For Su	b-Frames 2,3,7,8	Code	1			
		blocks				
Binary C	hannel Bits					
	b-Frames 0,1,4,5,6,9	Bits	1440			
For Su	b-Frames 2,3,7,8	Bits	1392			
Max. Thr	oughput averaged over 4 frames	Mbps	0.189			
UE DL C	ategory		0			
Note 1:	2 symbols allocated to PDCCH.					
Note 2:	Reference signal, synchronization si	gnals and F	PBCH			
	allocated as per TS 36.211 [4].					
Note 3:	The downlink subframes are schedu		, ,			
	2nd, 8th, 9th, 10th, 16th, 17th, 18th,					
	32nd, 33rd, 34th subframes every 40					
l	payload is availabe if downlink subfr					
Note 4:	Allocated PRB positions start from {					
1	where N is the number of allocated resource blocks.					

The reference measurement channels in Table A.3.3.3.2-4 apply with two CRS antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.2-4: Fixed Reference Channel for four antenna ports (CSI-RS)

Parameter	Unit	Value
Reference channel		R.69 FDD
Channel bandwidth	MHz	10
Allocated resource blocks		50
Allocated subframes per Radio Frame		8
Modulation		QPSK
Target Coding Rate		
For Sub-Frames 2,3,4,6,7,8,9		0.74
For Sub-Frame 1		0.8
Information Bit Payload		
For Sub-Frames 2,3,4,6,7,8,9	Bits	7992
For Sub-Frame 1	Bits	7992
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	N/A
Number of Code Blocks per Sub-Frame		
(Note 4)		
For Sub-Frames 2,3,4,6,7,8,9		2
For Sub-Frame 1		2
For Sub-Frame 5		N/A
For Sub-Frame 0		N/A
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 2,3,4,6,7,8,9	Bits	10800
For Sub-Frame 1	Bits	10000
2 For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	N/A
Max. Throughput averaged over 1 frame	Mbps	6.3936
UE Category		≥ 1
Note 1: 3 symbols allocated to PDCCH.		

Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4] Note 2:

If more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit) Note 3:

Eight antenna ports (CSI-RS) A.3.3.3.2A

The reference measurement channels in Table A.3.3.3.2A-1 apply for verifying FDD CRI accuracy measurement with two CRS antenna ports and eight CSI-RS antenna ports.

Table A.3.3.3.2A-1: Fixed Reference Channel for eight antenna ports (CSI-RS)

Parameter	Unit	Val	ue
Reference channel		R.50A-2	R.50A-3
		FDD	FDD
Channel bandwidth	MHz	10	10
Allocated resource blocks		50 ³	50 ³
Allocated subframes per Radio Frame		7	5
Modulation		64QAM	64QAM
Target Coding Rate		1/2	1/2
Information Bit Payload			
For Sub-Frames (Non CSI-RS subframe)	Bits	18336	18336
For Sub-Frames (CSI-RS subframe)	Bits	N/A	N/A
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A
subframe)			
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	14688	14688
Number of Code Blocks per Sub-Frame			
(Note 4)			
For Sub-Frames (Non CSI-RS subframe)		3	3
For Sub-Frames (CSI-RS subframe)		N/A	N/A
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A
subframe)			
For Sub-Frame 5		N/A	N/A
For Sub-Frame 0		3	3
Binary Channel Bits Per Sub-Frame			
For Sub-Frames (Non CSI-RS subframe)	Bits	36000	36000
For Sub-Frames (CSI-RS subframe)	Bits	N/A	N/A
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A	N/A
subframe)			
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	29520	29520
Max. Throughput averaged over 1 frame	Mbps	12.4704	8.8032
UE Category		≥ 2	≥ 2
Note 1: 2 symbols allocated to PDCCH for 2	20 MHz, 15 MI	Hz and 10 MHz	channel

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channe BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 3: For R.50A-2, 50 resource blocks are allocated in sub-frames 2, 3, 4, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.50A-3, 50 resource blocks are allocated in sub-frames 3, 4, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.3.3.3.3 Twelve antenna port (CSI-RS)

The reference measurement channels in Table A.3.3.3.3-1 apply for verifying PMI accuracy performance for UE-specific reference symbols with two cell-specific antenna ports and twelve CSI-RS antenna ports.

Table A.3.3.3-1: Fixed Reference Channel for CDM-multiplexed DM RS with twelve CSI-RS antenna ports

	Parameter	Unit	Value
Reference	e channel		R.77 FDD
Channel	bandwidth	MHz	10
Allocated	resource blocks		50 (Note 3)
	I subframes per Radio Frame		9
Modulation	on		64QAM
Target C	oding Rate		1/2
	on Bit Payload		
	b-Frames (Non CSI-RS	Bits	18336
subframe			
For Su	b-Frames (CSI-RS subframe)	Bits	16416
For Su	b-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe	e)		
For Su	b-Frame 5	Bits	N/A
For Su	b-Frame 0		14688
Number	of Code Blocks per Sub-Frame	Code	
	·	blocks	
For Su	b-Frames (Non CSI-RS	Code	3
subframe	e)	blocks	
	b-Frames (CSI-RS subframe)	Bits	3
For Su	b-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe	,		
	b-Frame 5		N/A
	b-Frame 0	Bits	3
	hannel Bits Per Sub-Frame		
	b-Frames (Non CSI-RS		36000
subframe			
	b-Frames (CSI-RS subframe)	Bits	32400
	b-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe	9)		
	b-Frame 5	Bits	N/A
	b-Frame 0	Bits	29520
	oughput averaged over 1	Mbps	15.7536
frame			
UE Cate			≥ 2
Note 1:	2 symbols allocated to PDCCH		
Note 2:	Reference signal, synchroniza		s and PBCH
No.	allocated as per TS 36.211 [4]		·
Note 3:	50 resource blocks are allocate		
	6, 7, 8, 9 and 41 resource bloc		
Note 4:	RB30–RB49) are allocated in s		
Note 4:	If more than one Code Block is		
	CRC sequence of L = 24 Bits i	s allached	i to each Code

A.3.3.3.4 Sixteen antenna port (CSI-RS)

The reference measurement channels in Table A.3.3.3.4-1 apply for verifying PMI accuracy performance for UE-specific reference symbols with two cell-specific antenna ports and sixteen CSI-RS antenna ports.

Block (otherwise L = 0 Bit).

Table A.3.3.3.4-1: Fixed Reference Channel for CDM-multiplexed DM RS with sixteen CSI-RS antenna ports

Paramter	Unit	Value
----------	------	-------

Reference channel		R.78 FDD
Channel bandwidth	MHz	10
Allocated resource blocks		50 (Note 3)
Allocated subframes per Radio Frame		9
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames (Non CSI-RS	Bits	11448
subframe)		
For Sub-Frames (CSI-RS subframe)	Bits	9912
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe)		
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0		9528
Number of Code Blocks per Sub-Frame	Code	
·	blocks	
For Sub-Frames (Non CSI-RS	Code	2
subframe)	blocks	
For Sub-Frames (CSI-RS subframe)	Bits	2
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe)		
For Sub-Frame 5		N/A
For Sub-Frame 0	Bits	2
Binary Channel Bits Per Sub-Frame		
For Sub-Frames (Non CSI-RS		24000
subframe)		
For Sub-Frames (CSI-RS subframe)	Bits	20800
For Sub-Frames (ZeroPowerCSI-RS	Bits	N/A
subframe)		
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	19680
Max. Throughput averaged over 1	Mbps	9.804
frame		
UE Category		≥ 2

Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]. Note 2:

Note 3: 50 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0.

Note 4:

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

A.3.4 Reference measurement channels for PDSCH performance requirements (TDD)

A.3.4.1 Single-antenna transmission (Common Reference Symbols)

Table A.3.4.1-1: Fixed Reference Channel QPSK R=1/3

Parameter	Unit				Value			
Reference channel		R.4	R.42	R.2A	R.2	R.42-1	R.42-2	R.42-3
		TDD	TDD	TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	1.4	20	10	10	3	5	15
Allocated resource blocks (Note 6)		6	100	50	50	15	25	75
Uplink-Downlink Configuration (Note 4)		1	1	2	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3	3+2	5+2	3+2	3+2	3+2	3+2
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3	1/3
Information Bit Payload (Note 6)								
For Sub-Frames 4,9	Bits	408	8760	4392	4392	1320	2216	6712
For Sub-Frames 1,6	Bits	N/A	7736	3240	3240	1128	1864	5992
For Sub-Frames 3,8	Bits	N/A	N/A	4392	N/A	N/A	N/A	N/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	208	8760	4392	4392	1064	1800	6712
Number of Code Blocks								
(Notes 5 and 6)								
For Sub-Frames 4,9		1	2	1	1	1	1	2
For Sub-Frames 1,6		N/A	2	1	1	1	1	1
For Sub-Frames 3,8		N/A	N/A	1	N/A	N/A	N/A	N/A
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	2	1	1	1	1	2
Binary Channel Bits (Note 6)								
For Sub-Frames 4,9	Bits	1368	27600	13800	13800	3780	6300	20700
For Sub-Frames 1,6	Bits	N/A	22656	11256	11256	3276	5556	16956
For Sub-Frames 3,8		N/A	N/A	13800	N/A	N/A	N/A	N/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	672	26904	13104	13104	3084	5604	20004
Max. Throughput averaged over 1 frame	Mbps	0.102	4.175	2.844	1.966	0.596	0.996	3.212
(Note 6)								
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1	≥ 1

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.

Note 3: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 4: As per Table 4.2-2 in TS 36.211 [4].

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 6: Given per component carrier per codeword.

Table A.3.4.1-2: Fixed Reference Channel 16QAM R=1/2

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Parameter	Unit			Va	lue		
Reference channel				R.3-1	R.3		
				TDD	TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Uplink-Downlink Configuration (Note 3)				1	1		
Allocated subframes per Radio Frame (D+S)				3+2	3+2		
Modulation				16QAM	16QAM		
Target Coding Rate				1/2	1/2		
Information Bit Payload							
For Sub-Frames 4,9	Bits			6456	14112		
For Sub-Frames 1,6	Bits			5160	11448		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			5736	12960		
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9				2	3		
For Sub-Frames 1,6				1	2		
For Sub-Frame 5				N/A	N/A		
For Sub-Frame 0				1	3		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits			12600	27600		
For Sub-Frames 1,6	Bits			11112	22512		
For Sub-Frame 5	Bits			N/A	N/A		
For Sub-Frame 0	Bits			11208	26208		
Max. Throughput averaged over 1 frame	Mbps			2.897	6.408		
UE Category				≥ 1	≥ 2		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-3: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit			Val	ue		
Reference channel			R.5	R.6 TDD	R.7	R.8	R.9
			TDD		TDD	TDD	TDD
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks			15	25	50	75	100
Uplink-Downlink Configuration (Note 3)			1	1	1	1	1
Allocated subframes per Radio Frame (D+S)			3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate			3/4	3/4	3/4	3/4	3/4
Information Bit Payload							
For Sub-Frames 4,9	Bits		8504	14112	30576	46888	61664
For Sub-Frames 1,6	Bits		6968	11448	23688	35160	46888
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		6968	12576	30576	45352	61664
Number of Code Blocks per Sub-Frame							
(Note 4)							
For Sub-Frames 4,9			2	3	5	8	11
For Sub-Frames 1,6			2	2	4	6	8
For Sub-Frame 5			N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0			2	3	5	8	11
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits		11340	18900	41400	62100	82800
For Sub-Frames 1,6	Bits		9828	16668	33768	50868	67968
For Sub-Frame 5	Bits		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits		9252	16812	39312	60012	80712
Max. Throughput averaged over 1 frame	Mbps		3.791	6.370	13.910	20.945	27.877
UE Category			≥ 1	≥2	≥2	≥ 2	≥ 3

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: As per Table 4.2-2 TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-3a: Fixed Reference Channel 64QAM R=3/4

Parameter	Unit		Val	ue		
Reference channel		R.6-1	R.7-1	R.8-1	R.9-1	R.9-2
		TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	5	10	15	20	20
Allocated resource blocks (Note 3)		18	17	17	17	83
Uplink-Downlink Configuration (Note 4)		1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2	3+2
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4
Information Bit Payload						
For Sub-Frames 4,9	Bits	10296	10296	10296	10296	51024
For Sub-Frames 1,6	Bits	8248	7480	7480	7480	39232
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	8248	10296	10296	10296	51024
Number of Code Blocks per Sub-Frame						
(Note 5)						
For Sub-Frames 4,9		2	2	2	2	9
For Sub-Frames 1,6		2	2	2	2	7
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		2	2	2	2	9
Binary Channel Bits Per Sub-Frame						
For Sub-Frames 4,9	Bits	13608	14076	14076	14076	68724
For Sub-Frames 1,6	Bits	11880	11628	11628	11628	56340
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	11520	14076	14076	14076	66636
Max. Throughput averaged over 1 frame	Mbps	4.534	4.585	4.585	4.585	23.154
UE Category		≥ 1	≥ 1	≥ 1	≥ 1	≥ 2

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: Localized allocation started from RB #0 is applied.

Note 4: As per Table 4.2-2 TS 36.211 [4].

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-4: Fixed Reference Channel Single PRB

Parameter	Unit			Val	ue		
Reference channel			R.0 TDD		R.1 TDD		
Channel bandwidth	MHz	1.4	3	5	10/20	15	20
Allocated resource blocks			1		1		
Uplink-Downlink Configuration (Note 3)			1		1		
Allocated subframes per Radio Frame (D+S)			3+2		3+2		
Modulation			16QAM		16QAM		
Target Coding Rate			1/2		1/2		
Information Bit Payload							
For Sub-Frames 4,9	Bits		224		256		
For Sub-Frames 1,6	Bits		208		208		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		224		256		
Number of Code Blocks per Sub-Frame (Note 4)							
For Sub-Frames 4,9			1		1		
For Sub-Frames 1,6			1		1		
For Sub-Frame 5			N/A		N/A		
For Sub-Frame 0			1		1		
Binary Channel Bits Per Sub-Frame							
For Sub-Frames 4,9	Bits		504		552		
For Sub-Frames 1,6	Bits		456		456		
For Sub-Frame 5	Bits		N/A		N/A		
For Sub-Frame 0	Bits		504		552		
Max. Throughput averaged over 1 frame	Mbps		0.109		0.118		
UE Category			≥ 1		≥ 1		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-5: Fixed Reference Channel Single PRB (MBSFN Configuration)

Parameter	Unit	Value
Reference channel		R.29 TDD
		(MBSFN)
Channel bandwidth	MHz	10
Allocated resource blocks		1
MBSFN Configuration (Note 5)		010010
Uplink-Downlink Configuration (Note 3)		1
Allocated subframes per Radio Frame (D+S)		1+2
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames 4,9	Bits	0 (MBSFN)
For Sub-Frames 1,6	Bits	208
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	256
Number of Code Blocks per Sub-Frame		
(Note 4)		
For Sub-Frames 4,9	Bits	0 (MBSFN)
For Sub-Frames 1,6	Bits	1
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	1
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 4,9	Bits	0 (MBSFN)
For Sub-Frames 1,6	Bits	456
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	552
Max. Throughput averaged over 1 frame	kbps	67.2
UE Category		≥ 1

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

as per Table 4.2-2 in TS 36.211 [4]. Note 3:

Note 4: If more than one Code Block is present, an additional CRC

sequence of L = 24 Bits is attached to each Code Block (otherwise

L = 0 Bit).

MBSFN Subframe Allocation as defined in [7], one frame with 6 bits is chosen for MBSFN subframe allocation Note 5:

Table A.3.4.1-6: Fixed Reference Channel QPSK R=1/10

Parameter	Unit	Value							
Reference channel					R.41 TDD				
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks					50				
Uplink-Downlink Configuration (Note 4)					1				
Allocated subframes per Radio Frame (D+S)					3+2				
Modulation					QPSK				
Target Coding Rate					1/10				
Information Bit Payload									
For Sub-Frames 4,9	Bits				1384				
For Sub-Frames 1,6	Bits				1032				
For Sub-Frame 5	Bits				N/A				
For Sub-Frame 0	Bits				1384				
Number of Code Blocks per Sub-Frame									
(Note 5)									
For Sub-Frames 4,9					1				
For Sub-Frames 1,6					1				
For Sub-Frame 5					N/A				
For Sub-Frame 0					1				
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 4,9	Bits				13800				
For Sub-Frames 1,6	Bits				11256				
For Sub-Frame 5	Bits				N/A				
For Sub-Frame 0	Bits				13104				
Max. Throughput averaged over 1 frame	Mbps				0.622				
UE Category	•				≥ 1				

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.
- Note 3: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]
- Note 4: As per Table 4.2-2 in TS 36.211 [4].
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.4.1-7: Fixed Reference Channel for CA demodulation with power imbalance

Parameter	Unit	Val	ue
Reference channel		R.49 TDD	R.49-1 TDD
Channel bandwidth	MHz	20	15
Allocated resource blocks		100	75
Uplink-Downlink Configuration (Note 1)		1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2
Modulation		64QAM	64QAM
Number of OFDM symbols for PDCCH per component carrier			
For Sub-Frames 0,4,5,9	OFDM symbols	3	3
For Sub-Frames 1,6	OFDM symbols	2	2
Target Coding Rate			
For Sub-Frames 4,9		0.84	0.83
For Sub-Frames 1,6		0.81	0.80
For Sub-Frames 5		N/A	N/A
For Sub-Frames 0		0.87	0.86
Information Bit Payload			
For Sub-Frames 0, 4, 9	Bits	63776	46888
For Sub-Frame 1,6	Bits	55056	40576
For Sub-Frame 5	Bits	N/A	N/A
Number of Code Blocks per Sub-Frame (Note 2)			
For Sub-Frames 0, 4, 9	Code Blocks	11	8
For Sub-Frame 1,6	Code Blocks	9	7
For Sub-Frame 5	Code Blocks	N/A	N/A
Binary Channel Bits Per Sub-Frame			
For Sub-Frames 4,9	Bits	75600	56700
For Sub-Frame 1,6	Bits	67968	50868
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	73512	54612
Max. Throughput averaged over 1 frame	Mbps	30.144	22.182
UE Category		≥5	≥ 3

Note 1: Reference signal, synchronization signals and PBC allocated as per TS 36.211 [4].

Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

A.3.4.2 Multi-antenna transmission (Common Reference Signals)

A.3.4.2.1 Two antenna ports

Table A.3.4.2.1-1: Fixed Reference Channel two antenna ports

Parameter			Uı	nit			Value					
Reference channel		R.10 TDD	R.11 TDD	R.11-1 TDD	R.11-2 TDD	R.11-3 TDD Note 6	R.11-4 TDD	R.30 TDD	R.30-1 TDD	R.30-2 TDD	R.35 TDD	R.35-1 TDD
Channel bandwidth	MHz	10	10	10	5	10	10	20	20	20	10	20
Allocated resource blocks (Note 5)		50	50	50	25	40	50	100	100	100	50	100
Uplink-Downlink Configuration (Note 3)		1	1	1	1	1	1	1	1	1	1	1
Allocated subframes per Radio Frame (D+S)		3+2	3+2	2+2	3+2	3+2	2	3+2	2+2	2	2+2	2
Modulation		QPSK	16QAM	16QAM	16QAM	16QAM	QPSK	16QAM	16QAM	16QAM	64QAM	64QAM
Target Coding Rate		1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.39
Information Bit Payload (Note 5)												
For Sub-Frames 4,9	Bits	4392	12960	12960	5736	10296	6968	25456	25456	25456	19848	30576
For Sub-Frames 1,6		3240	9528	9528	5160	9144	N/A	22920	21384	N/A	15840	N/A
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	4392	12960	N/A	4968	10296	N/A	25456	N/A	N/A	N/A	N/A
Number of Code Blocks (Notes 4 and 5)												
For Sub-Frames 4,9		1	3	3	1	2	2	5	5	5	4	5
For Sub-Frames 1,6		1	2	2	1	2	N/A	4	4	N/A	3	N/A
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	3	N/A	1	2	N/A	5	N/A	N/A	N/A	N/A
Binary Channel Bits (Note 5)												
For Sub-Frames 4,9	Bits	13200	26400	26400	12000	21120	13200	52800	52800	52800	39600	79200

For Sub-Frames		10656	21312	21312	10512	16992	10656	42912	42912	N/A	31968	N/A
1,6												
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	12528	25056	N/A	10656	19776	12528	51456	N/A	N/A	N/A	N/A
Max. Throughput	Mbps	1.966	5.794	4.498	2.676	4.918	1.39	12.221	9.368	5.091	7.138	6.115
averaged over 1												
frame (Note 5)												
UE Category		≥ 1	≥ 2	≥ 2	≥ 1	≥ 1	≥ 1	≥ 2	≥ 2	3	≥ 2	4

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Given per component carrier per codeword.
- Note 6: For R.11-3 resource blocks of RB6–RB45 are allocated.

Table A.3.4.2.1-2: Fixed Reference Channel two antenna ports

Parameter	Unit	Value											
Reference channel		R.46 TDD	R.47 TDD	R.35-2	R.11-5	R.11-6	R.11-7	R.11-8	R.11-9	R.11-10	R.11-11	R.11-12	R.10-3
				TDD	TDD	TDD	TDD						
Channel bandwidth	MHz	10	10	10	1.4	3	5	10	15	10	10	10	10
Allocated resource blocks (Note		50	50	50	6	15	25	50	75	50	50	50	50
5)													
Uplink-Downlink Configuration		1	1	1	1	1	1	1	1	1	1	1	1
(Note 3)													
Allocated number of PDCCH		2	2	2	4	3	3	2	2	2	3	3	2
symbols in normal subframes			2		7	3	3		2		3	3	
Allocated number of PDCCH		2	2	2	2	2	2	2	2	2	2	2	2
symbols in special subframes													
Allocated subframes per Radio		3+2	3+2	2+2	2+2	2+2	2+2	2+2	2+2	3+2	2+2	2+2	3+2
Frame (D+S)													
Modulation		QPSK	16QAM	64QAM	16QAM	16QAM	16QAM	16QAM	16QAM	QPSK	QPSK	QPSK	16QAM
Target Coding Rate				0.47	1/2	1/2	1/2	1/2	1/2	3/5			
For Sub-Frames 4,9											0.58	0.66	0.58
For Sub-Frames 1,6											0.48	0.54	0.57
Information Bit Payload (Note 5)													
For Sub-Frames 4,9	Bits	5160	8760	18336	1352	3368	5736	12960	19080	7992	6968	7992	15264
For Sub-Frames 1,6		3880	7480	14688	1128	3112	5160	10680	15840	5736	5160	5736	12216
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	5160	8760	N/A	N/A	N/A	N/A	N/A	N/A	7992	N/A	N/A	14112
Number of Code Blocks													
(Notes 4 and 5)													
For Sub-Frames 4,9		1	2	3	1	1	1	3	4	2	2	2	3
For Sub-Frames 1,6		1	2	3	1	1	1	2	3	1	1	1	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	2	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	N/A	3
Binary Channel Bits (Note 5)													
For Sub-Frames 4,9	Bits	13200	26400	39600	2592	7200	12000	26400	39600	13200	12000	12000	26400
For Sub-Frames 1,6		10656	21312	31968	2304	6192	10512	21312	32112	10656	10656	10656	21312
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	12528	25056	N/A	N/A	N/A	N/A	N/A	N/A	12528	N/A	N/A	25056
Max. Throughput averaged over	Mbps	2.324	4.124	6.604	0.496	1.296	2.179	4.498	6.984	3.5448	2.4256	2.7456	6.9072
1 frame (Note 5)	•												
UE Category		≥ 1	≥ 1	≥ 2	≥ 1	≥ 1	≥ 1	≥ 2	≥ 2	≥ 2	≥ 1	≥ 1	≥ 1
Note 1. Void		•								•			

Note 1: Void

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Given per component carrier per codeword

Table A.3.4.2.1-3: Fixed Reference Channel two antenna ports

Parameter	Unit	Va	lue
Reference channel		R.62 TDD	R.63 TDD
Channel bandwidth	MHz	10	10
Allocated resource blocks (Note 4)		3	1
Uplink-Downlink Configuration (Note 3)		1	1
Allocated subframes per Radio Frame		4+2	4+2
(D+S)			
Modulation		16QAM	64QAM
Target Coding Rate		1/2	1/2
Information Bit Payload			
For Sub-Frames 0,4,5,9	Bits	744	408
For Sub-Frames 1,6	Bits	440	280
Number of Code Blocks			
For Sub-Frames 0,4,5,9	Code	1	1
	blocks		
For Sub-Frames 1,6	Clode	1	1
	blocls		
Binary Channel Bits			
For Sub-Frames 0,4,5,9	Bits	1584	792
For Sub-Frames 1,6		1296	648
Max. Throughput averaged over 1 frame	Mbps	0.3856	0.2192
UE DL Category		0	0

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3:

As per Table 4.2-2 in TS 36.211 [4]. Allocated PRB positions start from {9, 10, ..., 9+N-1}, where N is the Note 4: number of allocated resource blocks.

Table A.3.4.2.1-4: Fixed Reference Channel two antenna ports

Parameter	Unit											
Reference channel		R.65 TDD										
Channel bandwidth	MHz	20										
Allocated resource blocks (Note		100										
Uplink-Downlink Configuration (1										
Allocated subframes per Radio		2+2										
(D+S)												
Modulation		256QAM										
Target Coding Rate												
Information Bit Payload (Note 5)											
For Sub-Frames 4,9	Bits	63776										
For Sub-Frames 1,6		46888										
For Sub-Frame 5	Bits	N/A										
For Sub-Frame 0	Bits	N/A										
Number of Code Blocks												
(Notes 4 and 5)												
For Sub-Frames 4,9		11										
For Sub-Frames 1,6		9										
For Sub-Frame 5		N/A										
For Sub-Frame 0		N/A										
Binary Channel Bits (Note 5)												
For Sub-Frames 4,9	Bits	115200										
For Sub-Frames 1,6		95424										
For Sub-Frame 5	Bits	N/A										
For Sub-Frame 0	Bits	N/A										
Max. Throughput averaged ove	r 1 frame Mbps	22.133										
(Note 5)												
UE Category		11-12										
UE DL Category		≥ 11										
	o PDCCH for 20 MHz,											
	ols allocated to PDCCI											
	PDCCH for 1.4 MHz. F											
OFDM symbols are a	Illocated to PDCCH. Fo	or 256QAM refer	ence									
channel 1 symbol is allocated.												
Note 2: Reference signal, synchronization signals and PBCH allocated as per												
TS 36.211 [4].												
Note 3: As per Table 4.2-2 in												
	le Block is present, an											
	d to each Code Block	(otherwise $L = 0$	Bit).									
Note 5: Given per componen	carrier per codeword		Note 5: Given per component carrier per codeword									

Table A.3.4.2.1-5: Fixed Reference Channel two antenna ports when *EIMTA-MainConfigServCell-r12* is configured

Parameter	Unit	t Value							
Reference channel		R.67 TDD							
Channel bandwidth	MHz				10				
Allocated resource blocks (Note 5)					50				
Modulation					16QAM				
Target Coding Rate					0.4				
Dynamic Uplink-Downlink Configuration (Note 3)		0	1	2	3	4	5	6	
Allocated subframes per Radio Frame (D+S)		1+2	3+2	5+2	5+1	6+1	7+1	2+2	
Information Bit Payload (Note 5)									
For Sub-Frame 0	Bits	9912	9912	9912	9912	9912	9912	9912	
For Sub-Frame 1	Bits	7480	7480	7480	7480	7480	7480	7480	
For Sub-Frame 2	Bits	NA	NA	NA	NA	NA	NA	NA	
For Sub-Frame 3	Bits	NA	NA	9912	NA	NA	9912	NA	
For Sub-Frame 4	Bits	NA	9912	9912	NA	9912	9912	NA	
For Sub-Frame 5	Bits	NA	NA	NA	NA	NA	NA	NA	
For Sub-Frame 6	Bits	7480	7480	7480	9912	9912	9912	7480	
For Sub-Frame 7	Bits	NA	NA	NA	9912	9912	9912	NA	
For Sub-Frame 8	Bits	NA	NA	9912	9912	9912	9912	NA	
For Sub-Frame 9	Bits	NA	9912	9912	9912	9912	9912	9912	

Number of Code Blocks (Notes 4 and 5)								
For Sub-Frame 0		2	2	2	2	2	2	2
For Sub-Frame 1		2	2	2	2	2	2	2
For Sub-Frame 2		NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 3		NA	NA	2	NA	NA	2	NA
For Sub-Frame 4		NA	2	2	NA	2	2	NA
For Sub-Frame 5		NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 6		2	2	2	2	2	2	2
For Sub-Frame 7		NA	NA	NA	2	2	2	NA
For Sub-Frame 8		NA	NA	2	2	2	2	NA
For Sub-Frame 9		NA	2	2	2	2	2	2
Binary Channel Bits (Note 5)								
For Sub-Frame 0	Bits	25056	25056	25056	25056	25056	25056	25056
For Sub-Frame 1	Bits	21312	21312	21312	21312	21312	21312	21312
For Sub-Frame 2	Bits	NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 3	Bits	NA	NA	26400	NA	NA	26400	NA
For Sub-Frame 4	Bits	NA	26400	26400	NA	26400	26400	NA
For Sub-Frame 5	Bits	NA	NA	NA	NA	NA	NA	NA
For Sub-Frame 6	Bits	21312	21312	21312	26112	26112	26112	21312
For Sub-Frame 7	Bits	NA	NA	NA	26400	26400	26400	NA
For Sub-Frame 8	Bits	NA	NA	26400	26400	26400	26400	NA
For Sub-Frame 9	Bits	NA	26400	26400	26400	26400	26400	26400
Max. Throughput averaged over 1 frame (Note 5)	Mbps	2.49	4.47	6.45	5.70	6.70	7.69	3.48
Max. Throughput averaged over 1 frame and	Mbps	s 5.28						
over all dynamic UL-DL configurations (Note 5)								
UE Category					≥ 1			

- Note 1: 2 OFDM symbols are allocated to PDCCH in all subframes
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Given per component carrier per codeword.

Table A.3.4.2.1-6: Fixed Reference Channel two antenna ports

Parameter	Unit	Values
Reference channel		R.79 TDD
Channel bandwidth	MHz	10
Allocated resource blocks (Note 4)		3
Allocated subframes per Radio Frame (D+S)		4+2
Modulation		16QAM
Target Coding Rate		1/2
Information Bit Payload		
For Sub-Frames 0,4,5,9	Bits	744
For Sub-Frames 1,6	Bits	440
Number of Code Blocks		
For Sub-Frames 0,4,5,9	Code	1
	blocks	
For Sub-Frames 0,4,5,9	Code	1
	blocks	
Binary Channel Bits		
For Sub-Frames 0,4,5,9	Bits	1584
For Sub-Frames 1,6	Bits	1296
Max. Throughput averaged over 1 frame	Mbps	0.3856
UE DL Category		M1, ≥ 0

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: Allocated PRB positions for PDSCH are {3, 4, 5} within the assigned narrowband. Allocated PRB positions for MPDCCH are {0, 1} within the assigned narrowband.

Table A.3.4.2.1-7: Fixed Reference Channel two antenna ports

Parameter	Unit		Value	
Reference channel		R.81 TDD	R.81-1 TDD	R.81-2 TDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks (Note 4)		6	6	6
Uplink-Downlink Configuration (Note 3)		1	1	1
Allocated PDSCH subframes		Note 6	Note 7	Note 8
Modulation		QPSK	QPSK	QPSK
Target Coding Rate		1/10	1/10	1/10
Information Bit Payload				
For Sub-Frames 0,4,5,9	Bits	152	152	152
For Sub-Frames 1,6	Bits	N/A	N/A	N/A
Number of Code Blocks				
For Sub-Frames 0,4,5,9	Code	1	1	1
	blocks			
For Sub-Frames 1,6	Clode	N/A	N/A	N/A
	blocls			
Binary Channel Bits				
For Sub-Frames 0,4,5,9	Bits	1584	1584	1584
For Sub-Frames 1,6		N/A	N/A	N/A
Max. Throughput averaged over one period	kbps	0.297	0.594	1.9
UE DL Category		M1, ≥ 0	≥1	≥1

- Note 1: 2 symbols allocated to PDCCH.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: Allocated PRB positions are {0, 1, 2, 3, 4, 5} within the assigned narrowband.
- Note 5: The allocated PRB positions are {0, 1, 2, 3, 4, 5} within the assigned narrowband. If it is not the BL/CE DL subframes, MPDCCH/PDSCH transmission is postponed until the next BL/CE DL subframe. Note the DL subframes in the TDD uplink-downlink configuration are considered as the BL/CE DL subframes
- Note 6: MPDCCH are scheduled at the 0th to 63rd BL/CE DL subframes with repetition every period=512ms. The associated PDSCH is scheduled at the 65th to 128th BL/CE DL subframes with repetition every 512ms (starting from the 0th subframe).
- Note 7: MPDCCH are scheduled at the 0th to 31rd BL/CE DL subframes with repetition every period=256ms. The associated PDSCH is scheduled at the 33rd to 64 rd BL/CE DL subframes with repetition every 256ms (starting from the 0th subframe).
- Note 8: MPDCCH are scheduled at the 0th to 7rd BL/CE DL subframes with repetition every period=80ms. The associated PDSCH is scheduled at the 9rd to 24 rd BL/CE DL subframes with repetition every 80ms (starting from the 0th subframe).

A.3.4.2.2 Four antenna ports

Table A.3.4.2.2-1: Fixed Reference Channel four antenna ports

Parameter	Unit		Value													
Reference channel		R.12	R.13	R.14	R.14-	R.14-	R.43	R.36	R.43-	R.43-	R.43-	R.43-	R.43-	R.72	R.73	R.74
		TDD	TDD	TDD	1 TDD	2 TDD	TDD	TDD	1 TDD	2 TDD	3 TDD	4 TDD	5 TDD	TDD	TDD	TDD
Channel bandwidth	MHz	1.4	10	10	10	10	20	10	1.4	3	5	10	15	10	10	10
Allocated resource		6	50	50	6	3	100	50	6	15	25	50	75	50	50	50
blocks (Note 6)																
Uplink-Downlink		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Configuration (Note																
4)		_	0.0	0.0	0	0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Allocated subframes		3	3+2	2+2	2	2	2+2	2+2	2	2+2	2+2	2+2	2+2	2+2	2+2	2+2
per Radio Frame (D+S)																
Modulation		QPS	QPS	16Q	16QA	16QA	16Q	64Q	16QA	16QA	16QA	16QA	16QA	256Q	64QAM	16QA
Modulation		K	K	AM	M	M	AM	AM	M	M	M	M	M	AM	04QAW	M
Target Coding Rate		1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	0.62	0.44	1/2
Information Bit		.,,	.,,	.,_				.,_	.,_			,,,	,,,	0.02	0	
Payload (Note 6)																
For Sub-Frames	Bits	408	4392	1296	1544	744	2545	1833	1192	3368	5736	12960	19080	31704	16416	25456
4,9				0			6	6							(CW0)	
															32856	
															(CW1)	
For Sub-Frames	Bits	N/A	3240	9528	N/A	N/A	2138	1584	N/A	2856	5160	10680	15840	23688	12216	19080
1,6							4	0							(CW0)	
															24496	
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	(CW1) N/A	N/A
For Sub-Frame 0	Bits	208	4392	N/A	N/A N/A	N/A N/A	N/A	N/A	N/A N/A	N/A N/A	N/A	N/A N/A	N/A N/A	N/A	N/A	N/A N/A
Number of Code	DIG	200	4392	IN/A	IN/A	IN/A	IN/A	IN/A	IN/A	IN/A	IN/A	IN/A	IN/A	IN/A	IN/A	IN/A
Blocks																
(Notes 5 and 6)																
For Sub-Frames		1	1	3	1	1	5	3	1	1	1	3	4	3	3 (CW0)	5
4,9															6 (CW1)	
For Sub-Frames		N/A	1	2	N/A	N/A	4	3	N/A	1	1	2	3	3	2 (CW0)	4
1,6															4 (CW1)	
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Binary Channel Bits						1				1				1		1
(Note 6)																
For Sub-Frames	Bits	1248	1280	2560	3072	1536	5120	3840	2496	6960	11600	25600	38400	51200	38400	51200
4,9			0	0			0	0			1				(CW0)	

															76800 (CW1)	
For Sub-Frames 1,6		N/A	1025 6	2051 2	N/A	N/A	4131 2	3076 8	N/A	5952	10112	20512	30912	41024	30768 (CW0) 61536 (CW1)	41024
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	624	1217 6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max. Throughput averaged over 1 frame (Note 6)	Mbp s	0.10 2	1.96 6	4.49 8	0.309	0.149	9.36 8	6.83 5	0.238	1.245	2.179	4.728	6.984	18.44 5	5.726 (CW0) 11.470 (CW1)	8.907
UE Category		≥ 1	≥ 1	≥2	≥ 1	≥ 1	≥2	≥2	≥ 1	≥ 1	≥ 1	≥2	≥ 2	≥ 11	≥ 5	≥ 5

- Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.
- Note 2: For BW=1.4 MHz, the information bit payloads of special subframes are set to zero (no scheduling) to avoid problems with insufficient PDCCH performance at the test point.
- Note 3: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 4: As per Table 4.2-2 in TS 36.211 [4].
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Given per component carrier per codeword.

A.3.4.3 Reference Measurement Channels for UE-Specific Reference Symbols

A.3.4.3.1 Single antenna port (Cell Specific)

The reference measurement channels in Table A.3.4.3.1-1 apply for verifying demodulation performance for UE-specific reference symbols with one cell-specific antenna port.

Table A.3.4.3.1-1: Fixed Reference Channel for DRS

Parameter	Unit	Value							
Reference channel		R.25 TDD	R.26 TDD	R.26-1 TDD	R.27 TDD	R.27-1 TDD	R.28 TDD		
Channel bandwidth	MHz	10	10	5	10	10	10		
Allocated resource blocks		50 ⁴	50 ⁴	25 ⁴	50 ⁴	18 ⁶	1		
Uplink-Downlink Configuration (Note 3)		1	1	1	1	1	1		
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2	3+2	3+2		
Modulation		QPSK	16QAM	16QAM	64QAM	64QAM	16QAM		
Target Coding Rate		1/3	1/2	1/2	3/4	3/4	1/2		
Information Bit Payload									
For Sub-Frames 4,9	Bits	4392	12960	5736	28336	10296	224		
For Sub-Frames 1,6	Bits	3240	9528	4584	22920	8248	176		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	2984	9528	3880	22152	10296	224		
Number of Code Blocks per Sub-Frame (Note 5)									
For Sub-Frames 4,9		1	3	1	5	2	1		
For Sub-Frames 1,6		1	2	1	4	2	1		
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0		1	2	1	4	2	1		
Binary Channel Bits Per Sub-Frame									
For Sub-Frames 4,9	Bits	12600	25200	11400	37800	13608	504		
For Sub-Frames 1,6	Bits	10356	20712	10212	31068	11340	420		
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A		
For Sub-Frame 0	Bits	10332	20664	7752	30996	13608	504		
Max. Throughput averaged over 1 frame	Mbps	1.825	5.450	2.452	12.466	4.738	0.102		
UE Category		≥ 1	≥ 2	≥ 1	≥ 2	≥ 1	≥ 1		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

The reference measurement channels in Table A.3.4.3.1-2 apply for verifying demodulation performance for UE-specific reference symbols with one cell-specific antenna port.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: For R.25, R.26 and R.27, 50 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0. For R.26-1, 25 resource blocks are allocated in sub-frames 1, 4, 6, 9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frame 0.

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 6: Localized allocation started from RB #0 is applied.

Table A.3.4.3.1-2: Fixed Reference Channel for DRS

Parameter	Unit	Value									
Reference channel		R.80 TDD	R.80-1	R.80-2							
			TDD	TDD							
Channel bandwidth	MHz	10	10	10							
Allocated resource blocks (Note 4)		6	6	6							
Uplink-Downlink Configuration (Note 3)		1	1	1							
Allocated PDSCH subframes		Note 6	Note 7	Note 8							
Modulation		QPSK	QPSK	QPSK							
Target Coding Rate		1/3	1/3	1/3							
Information Bit Payload											
For Sub-Frames 4,9	Bits	504	504	504							
For Sub-Frames 1,6		N/A	N/A	N/A							
For Sub-Frames 0,5	Bits	504	504	504							
Number of Code Blocks per Sub-Frame											
For Sub-Frames 4,9	Code	1	1	1							
	blocks										
For Sub-Frames 1,6	Code	N/A	N/A	N/A							
	blocks										
For Sub-Frames 0,5	Code	1	1	1							
	blocks										
Binary Channel Bits Per Sub-Frame											
For Sub-Frames 4,9	Bits	1440	1440	1440							
For Sub-Frames 1,6		N/A	N/A	N/A							
For Sub-Frames 0,5	Bits	1440	1440	1440							
Max. Throughput averaged over one period	kbps	6.3	12.6	25.2							
UE DL Category		M1, ≥ 0	≥1	≥1							
Note 1: 2 symbols allocated to PDCCH.											
Note 2: Reference signal, synchronization signal	gnals and P	BCH allocate	d as per TS	36.211 [4].							
Note 3: as per Table 4.2-2 in TS 36.211 [4].											
Note 4: Allocated PRB positions are {0, 1, 2,											
Note 5: The allocated PRB positions are {0,											
is not BL/CE DL subframes, MPDCC											
next BL/CE DL subframe. Note the D			uplink-downl	link							
	configuration are considered as the BL/CE DL subframes.										
period=80ms. The associated PDSC			to 16th BL/C	JE DL							
subframes every 80ms (starting from				4:							
Note 7: MPDCCH are scheduled at the 0th to											
period=40ms. The associated PDSC			I IO OTH BL/CI	E DL							
subframes every 40ms (starting from			th ropotition	ovorv							
Note 8: MPDCCH are scheduled at the 0th BL/CE DL subframes with repetition every											

A.3.4.3.2 Two antenna ports (Cell Specific)

The reference measurement channels in Table A.3.4.3.2-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports.

subframes every 20ms (starting from the 0th subframe).

period=20ms. The associated PDSCH is scheduled at the 1th to 2th BL/CE DL

Table A.3.4.3.2-1: Fixed Reference Channel for CDM-multiplexed DM RS

Reference channel		R.31 TDD	R.32 TDD	R.32-1 TDD	R.33 TDD	R.33-1 TDD	R.34 TDD
Channel bandwidth	MHz	10	10	5	10	10	10
Allocated resource	1711 12	50 ⁴	50 ⁴	25 ⁴	50 ⁴	18 ⁶	50 ⁴
blocks		00	00	20	00	10	00
Uplink-Downlink		1	1	1	1	1	1
Configuration (Note 3)							
Allocated subframes		3+2	3+2	3+2	3+2	3+2	3+2
per Radio Frame (D+S)							
Modulation		QPSK	16QAM	16QAM	64QAM	64QAM	64QAM
Target Coding Rate		1/3	1/2	1/2	3/4	3/4	1/2
Information Bit Payload							
For Sub-Frames 4,9	Bits	3624	11448	5736	27376	9528	18336
For Sub-Frames 1,6		2664	7736	3112	16992	7480	11832
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	2984	9528	3496	22152	9528	14688
Number of Code Blocks							
per Sub-Frame							
(Note 5)							
For Sub-Frames 4,9		1	2	1	5	2	3
For Sub-Frames 1,6		1	2	1	3	2	2
For Sub-Frame 5		N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		1	2	1	4	2	3
Binary Channel Bits Per							
Sub-Frame							
For Sub-Frames 4,9	Bits	12000	24000	10800	36000	12960	36000
For Sub-Frames 1,6		7872	15744	6528	23616	10368	23616
For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0	Bits	9840	19680	7344	29520	12960	29520
Max. Throughput	Mbps	1.556	4.79	2.119	11.089	4.354	7.502
averaged over 1 frame							
UE Category		≥ 1	≥ 2	≥ 1	≥ 2	≥ 1	≥ 2
Note 1: 2 symbols allo	cated to P	DCCH for	20 MHz, 1	5 MHz and	10 MHz ch	nannel BW;	3 symbols
Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.							
For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.							
Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].							
Note 3: as per Table 4.2-2 in TS 36.211 [4].							
Note 4: For R.31, R.32, R.33and R.34, 50 resource blocks are allocated in sub-frames 4,9 and 41							
resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the							

Note 4: For R.31, R.32, R.33and R.34, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. For R.32-1, 25 resouce blocks are allocated in sub-frames 4,9 and 17 resource blocks (RB0–RB7 and RB16–RB24) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1, 6.

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 6: Localized allocation started from RB #0 is applied.

The reference measurement channels in Table A.3.4.3.2-2 apply with two CRS antenna ports.

Table A.3.4.3.2-2: Fixed Reference Channel for CDM-multiplexed DM RS

Parameter	Unit	Value	
Reference channel		R.70 TDD	R.71 TDD
Channel bandwidth	MHz	10	10
Allocated resource blocks		50 (Note 4)	50 (Note 4)
Uplink-Downlink Configuration (Note 3)		1	1
Allocated subframes per Radio Frame (D+S)		2+2	2+2
Modulation		QPSK	16QAM
Target Coding Rate			
For Sub-Frames 4,9		0.65	0.6
For Sub-Frames 1,6		0.54	0.5
Information Bit Payload			
For Sub-Frames 4,9	Bits	6968	12960
For Sub-Frames 1,6	Bits	4264	7736
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A
Number of Code Blocks per Sub-Frame			
(Note 5)			
For Sub-Frames 4,9		2	3
For Sub-Frames 1,6		1	2
For Sub-Frame 5		N/A	N/A
For Sub-Frame 0		N/A	N/A
Binary Channel Bits Per Sub-Frame			
For Sub-Frames 4,9	Bits	10800	21600
For Sub-Frames 1,6	Bits	7872	15744
For Sub-Frame 5	Bits	N/A	N/A
For Sub-Frame 0	Bits	N/A	N/A
Max. Throughput averaged over 1 frame	Mbps	2.2464	4.1392
UE Category		≥ 1	≥ 2

- Note 1: 3 symbols allocated to PDCCH in normal subframes and 2 symbols allocated to PDCCH in special subframes
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: For R.63, and R.64, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in the DwPTS portion of sub-frames 1,6.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

A.3.4.3.3 Two antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.3-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports.

Table A.3.4.3.3-1: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports

Parameter	Unit		Value	
Reference channel		R.51 TDD	R.51-1 TDD	R.76 TDD
Channel bandwidth	MHz	10	10	10
Allocated resource blocks		50 (Note 5)	50 (Note 5)	50 (Note 5)
Uplink-Downlink Configuration (Note 3)		1	1	1
Allocated subframes per Radio Frame		3+2	3+2	3+2
(D+S)				
Modulation		16QAM	16QAM	QPSK
Target Coding Rate		1/2	0.57	
Information Bit Payload				
For Sub-Frames 4,9 (non CSI-RS	Bits	11448	N/A	6200
subframe)				
For Sub-Frame 4,9	Bits	11448	12960	6200
For Sub-Frames 1,6	Bits	7736	9144	4264
For Sub-Frame 5	Bits	N/A	N/A	n/a
For Sub-Frame 0	Bits	9528	10680	4968
Number of Code Blocks				
(Note 4)				
For Sub-Frames 4, 9 (non CSI-RS	Code	2	N/A	2
subframe)	blocks			
For Sub-Frames 4,9	Code	2	3	2
	blocks			
For Sub-Frames 1,6	Code	2	2	1
	blocks			
For Sub-Frame 5		N/A	N/A	N/A
For Sub-Frame 0	Code	2	2	1
	blocks			
Binary Channel Bits				
For Sub-Frames 4, 9 (non CSI-RS	Bits	24000	N/A	11800
subframe)				
For Sub-Frames 4,9		22800	22800	11800
For Sub-Frames 1,6		15744	15744	7872
For Sub-Frame 5	Bits	N/A	N/A	N/A
For Sub-Frame 0	Bits	19680	19680	9840
Max. Throughput averaged over 1	Mbps	4.7896	5.4888	2.5896
frame				
UE Category		≥ 2	≥ 2	≥ 2

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1.6

The reference measurement channels in Table A3.4.3.3-2 apply for verifying demudlation performance for UE-specific reference symbols with two cell specific antenna ports and two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS in same subframe.

Table A.3.4.3.3-2: Fixed Reference Channel for CDM-multiplexed DM RS with two CSI-RS antenna ports with ZP CSI-RS and NZP CSI-RS

Parameter	Unit	Jnit Value					
Reference channel		R.52 TDD	R.52-1 TDD	R.53 TDD	R.54 TDD		
Channel bandwidth	MHz	10	10	10	10		
Allocated resource blocks		50 (Note 5)	50 (Note 5)	50 (Note 5)	50 (Note 5)		
Uplink-Downlink Configuration (Note 3)		1	1	1	1		
Allocated subframes per Radio Frame (D+S)		3+2	3+2	3+2	3+2		
Modulation		64QAM	16QAM	64QAM	16QAM		
Target Coding Rate		1/2	0.57	1/2	1/2		
Information Bit Payload							
For Sub-Frame 4,9	Bits	16416	12960	16416	11448		
For Sub-Frames 1,6	Bits	11832	9144	11832	7736		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	14688	10680	14688	9528		
Number of Code Blocks (Note 4)							
For Sub-Frames 4,9	Code blocks	3	3	3	2		
For Sub-Frames 1,6	Code blocks	2	2	2	2		
For Sub-Frame 5		n/a	n/a	n/a	n/a		
For Sub-Frame 0	Code blocks	3	2	3	2		
Binary Channel Bits							
For Sub-Frames 4,9		34200	22800	33600	22800		
For Sub-Frames 1,6		23616	15744	23616	15744		
For Sub-Frame 5	Bits	n/a	n/a	n/a	n/a		
For Sub-Frame 0	Bits	29520	19680	29520	19680		
Max. Throughput averaged over 1 frame	Mbps	7.1184	5.4888	7.1184	4.7896		
UE Category		≥2	≥2	≥ 2	≥ 2		

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each

Code Block (otherwise L = 0 Bit).

Note 5: 50 resource blocks are allocated in sub-frames 4, 9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1, 6.

A.3.4.3.4 Four antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.4-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.4-1: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Reference channel	Parameter	Unit					
Allocated resource blocks	Reference channel		R.44 TDD	R.48 TDD	R.66 TDD	R.75 TDD	
Mathematics Mathematics	Channel bandwidth	MHz		10	20	10	
(Note 3)	Allocated resource blocks		50 (Note 4)		100	50 (Note 4)	
Frame (D+S) G4QAM QPSK 256QAM 16QAM	(Note 3)				•		
Target Coding Rate ½ 0.57 Information Bit Payload 8 0.57 For Sub-Frames 4,9 (non CSI-RS subframe) Bits 18336 N/A N/A N/A For Sub-Frames 4,9 (CSI-RS subframe) Bits 16416 6200 71112 25456 For Sub-Frames 1,6 11832 4264 48936 16992 For Sub-Frame 5 Bits N/A N/A N/A For Sub-Frame 0 Bits 14688 4968 66592 21384 Number of Code Blocks per Sub-Frame (Note 5) 8 14688 4968 66592 21384 For Sub-Frames 4,9 (non CSI-RS subframe) 3 2 1/2 5 For Sub-Frames 4,9 (CSI-RS subframe) 3 2 1/2 5 For Sub-Frame 5 N/A N/A N/A N/A For Sub-Frame 6 2 1 8 3 For Sub-Frames 4,9 (non CSI-RS subframe) 8its 36000 12000 N/A N/A For Sub-Frames 4,9 (CSI-RS subframe) 8its	Frame (D+S)					_	
Information Bit Payload For Sub-Frames 4,9 (non CSI-RS subframe) Bits 18336 N/A N/A N/A N/A Subframe) For Sub-Frames 4,9 (CSI-RS subframe) 11832 4264 48936 16992 For Sub-Frames 1,6 Bits N/A N			64QAM	QPSK	256QAM	16QAM	
For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frames 1,6 For Sub-Frames 1,6 For Sub-Frame 5 For Sub-Frame 0 N/A N/A For Sub-Frame 0 Number of Code Blocks per Sub-Frame (Note 5) For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frame 5 For Sub-Frame 5 For Sub-Frame 6 For Sub-Frame 8,9 (CSI-RS subframe) For Sub-Frame 5 For Sub-Frame 5 For Sub-Frame 5 For Sub-Frame 6 For Sub-Frame 8,9 (non CSI-RS subframe) For Sub-Frame 5 For Sub-Frame 5 For Sub-Frame 6 For Sub-Frame 8,9 (non CSI-RS subframe) For Sub-Frame 5 For Sub-Frame 6 For Sub-Frame 8,9 (non CSI-RS subframe) For Sub-Frame 8,9 (non CSI-RS subframe) For Sub-Frame 8,9 (non CSI-RS subframe) For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frame 5 Bits N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A			1/2			0.57	
Subframe For Sub-Frames 4,9 (CSI-RS Bits 16416 6200 71112 25456							
Subframe) 11832 4264 48936 16992 For Sub-Frame 5 Bits N/A N/A N/A N/A For Sub-Frame 0 Bits 14688 4968 66592 21384 Number of Code Blocks per Sub-Frame (Note 5) For Sub-Frames 4,9 (non CSI-RS subframe) 3 2 N/A N/A For Sub-Frames 4,9 (CSI-RS subframe) 3 2 12 5 For Sub-Frames 1,6 2 1 8 3 For Sub-Frame 5 N/A N/A N/A N/A For Sub-Frame 0 3 1 11 4 Binary Channel Bits Per Sub-Frame For Sub-Frames 4,9 (non CSI-RS subframe) Bits 36000 12000 N/A N/A For Sub-Frames 4,9 (CSI-RS subframe) Bits 33600 11600 89600 40000 Subframe) For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 Bits N/A N/A N/A N/A For Sub-Frame 6 Bits <td>subframe)</td> <td>Bits</td> <td>18336</td> <td>N/A</td> <td>N/A</td> <td>N/A</td>	subframe)	Bits	18336	N/A	N/A	N/A	
For Sub-Frame 5 Bits N/A N/A N/A N/A For Sub-Frame 0 Bits 14688 4968 66592 21384 Number of Code Blocks per Sub-Frame (Note 5) 3 2 N/A N/A For Sub-Frames 4,9 (non CSI-RS subframe) 3 2 12 5 For Sub-Frames 1,6 2 1 8 3 For Sub-Frame 5 N/A N/A N/A N/A For Sub-Frame 0 3 1 11 4 Binary Channel Bits Per Sub-Frame For Sub-Frames 4,9 (non CSI-RS subframe) Bits 36000 12000 N/A N/A For Sub-Frames 4,9 (CSI-RS subframe) Bits 33600 11600 89600 40000 For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 Bits N/A N/A N/A For Sub-Frame 6 23616 7872 67584 27552 For Sub-Frame 7 Bits 29520 9840 84480 35424		Bits	16416	6200	71112	25456	
For Sub-Frame 0 Bits 14688 4968 66592 21384 Number of Code Blocks per Sub-Frame (Note 5) 3 2 N/A N/A For Sub-Frames 4,9 (non CSI-RS subframe) 3 2 12 5 For Sub-Frames 4,9 (CSI-RS subframe) 3 2 12 5 For Sub-Frames 1,6 2 1 8 3 For Sub-Frame 5 N/A N/A N/A N/A For Sub-Frame 0 3 1 11 4 Binary Channel Bits Per Sub-Frame For Sub-Frames 4,9 (non CSI-RS subframe) Bits 36000 12000 N/A N/A For Sub-Frames 4,9 (CSI-RS subframe) Bits 33600 11600 89600 40000 For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 Bits N/A N/A N/A For Sub-Frame 0 Bits 29520 9840 84480 35424 Max. Throughput averaged over 1 frame DE Category ≥ 2 ≥ 1 <	For Sub-Frames 1,6		11832	4264	48936	16992	
Number of Code Blocks per Sub-Frame (Note 5) 3 2 N/A N/A For Sub-Frames 4,9 (non CSI-RS subframe) 3 2 12 5 For Sub-Frames 4,9 (CSI-RS subframe) 3 2 12 5 For Sub-Frames 1,6 2 1 8 3 For Sub-Frame 5 N/A N/A N/A N/A For Sub-Frame 0 3 1 11 4 Binary Channel Bits Per Sub-Frame 8 36000 12000 N/A N/A For Sub-Frames 4,9 (non CSI-RS subframe) 8 33600 11600 89600 40000 For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 Bits N/A N/A N/A N/A For Sub-Frame 0 Bits 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5	For Sub-Frame 5	Bits	N/A	N/A	N/A	N/A	
Frame (Note 5) For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frames 1,6 For Sub-Frame 5 For Sub-Frame 0 Binary Channel Bits Per Sub-Frame For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frames 1,6 For Sub-Frames 1,6 For Sub-Frame 5 Bits 36000 11600 89600 40000 40000 89600 40000 40000 89600 40000 40000 89600 40000 40000 89600 For Sub-Frames 1,6 For Sub-Frame 5 Bits N/A N/A N/A N/A N/A N/A N/A MA N/A MA N/A MA N/A MA MA MA MA MA MA MA MA MA	For Sub-Frame 0	Bits	14688	4968	66592	21384	
For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frames 1,6 For Sub-Frame 5 For Sub-Frame 0 Binary Channel Bits Per Sub-Frame For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (non CSI-RS subframe) For Sub-Frames 4,9 (CSI-RS subframe) For Sub-Frames 1,6 For Sub-Frames 1,6 For Sub-Frames 1,6 For Sub-Frame 5 Bits 33600 11600 89600 40000 40000 89600 89600	Frame						
For Sub-Frames 4,9 (CSI-RS subframe) 3 2 12 5 For Sub-Frames 1,6 2 1 8 3 For Sub-Frame 5 N/A N/A N/A N/A For Sub-Frame 0 3 1 11 4 Binary Channel Bits Per Sub-Frame 8 36000 12000 N/A N/A For Sub-Frames 4,9 (non CSI-RS subframe) Bits 36000 12000 N/A N/A N/A For Sub-Frames 4,9 (CSI-RS subframe) Bits 33600 11600 89600 40000 For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 Bits N/A N/A N/A N/A For Sub-Frame 0 Bits 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5	For Sub-Frames 4,9 (non CSI-RS		3	2	N/A	N/A	
For Sub-Frames 1,6 2 1 8 3 For Sub-Frame 5 N/A N/A N/A N/A For Sub-Frame 0 3 1 11 4 Binary Channel Bits Per Sub-Frame 8 36000 12000 N/A N/A For Sub-Frames 4,9 (non CSI-RS subframe) 8 36000 12000 N/A N/A For Sub-Frames 4,9 (CSI-RS subframe) 8 33600 11600 89600 40000 For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 8its N/A N/A N/A N/A For Sub-Frame 0 8its 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5	For Sub-Frames 4,9 (CSI-RS		3	2	12	5	
For Sub-Frame 5 N/A N/A N/A N/A For Sub-Frame 0 3 1 11 4 Binary Channel Bits Per Sub-Frame 8 36000 12000 N/A N/A For Sub-Frames 4,9 (non CSI-RS subframe) 8 36000 11600 89600 40000 For Sub-Frames 4,9 (CSI-RS subframe) 8 33600 11600 89600 40000 For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 8its N/A N/A N/A N/A For Sub-Frame 0 8its 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5			2	1	8	3	
For Sub-Frame 0 3 1 11 4 Binary Channel Bits Per Sub-Frame 8 36000 12000 N/A N/A For Sub-Frames 4,9 (non CSI-RS subframe) 8 36000 11600 89600 40000 For Sub-Frames 4,9 (CSI-RS subframe) 8 33600 11600 89600 40000 For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 8its N/A N/A N/A N/A For Sub-Frame 0 8its 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5			N/A				
Binary Channel Bits Per Sub-Frame Bits 36000 12000 N/A N/A For Sub-Frames 4,9 (non CSI-RS subframe) Bits 33600 11600 89600 40000 For Sub-Frames 4,9 (CSI-RS subframe) Bits 33600 11600 89600 40000 For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 Bits N/A N/A N/A For Sub-Frame 0 Bits 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5							
subframe) Bits 33600 11600 89600 40000 subframe) For Sub-Frames 1,6 23616 7872 67584 27552 For Sub-Frame 5 Bits N/A N/A N/A N/A For Sub-Frame 0 Bits 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5	Binary Channel Bits Per Sub-						
subframe) 23616 7872 67584 27552 For Sub-Frame 5 Bits N/A N/A N/A N/A For Sub-Frame 0 Bits 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5	subframe)	Bits	36000	12000	N/A	N/A	
For Sub-Frame 5 Bits N/A N/A N/A N/A For Sub-Frame 0 Bits 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5		Bits	33600	11600	89600	40000	
For Sub-Frame 0 Bits 29520 9840 84480 35424 Max. Throughput averaged over 1 frame Mbps 7.1184 2.5896 30.669 10.628 UE Category ≥ 2 ≥ 1 11-12 ≥ 5	For Sub-Frames 1,6		23616	7872	67584	27552	
Max. Throughput averaged over 1 frameMbps7.11842.589630.66910.628UE Category≥ 2≥ 111-12≥ 5		Bits	N/A	N/A	N/A	N/A	
frame ≥2 ≥1 11-12 ≥5	For Sub-Frame 0	Bits	29520	9840	84480	35424	
		Mbps	7.1184	2.5896	30.669	10.628	
			≥ 2	≥ 1	11-12	≥ 5	
	UE DL Category		≥ 6	≥ 6	≥ 11	≥ 6	

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: For R.44,R.48 and R.75, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. For R.66, 100 resource blocks are allocated in sub-frames 4, 9 and 88 resources blockes (RB0–RB43 and RB56–RB99) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is

attached to each Code Block (otherwise L = 0 Bit).

The reference measurement channels in Table A.3.4.3.4-2 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.4-2: Fixed Reference Channel for four antenna ports (CSI-RS)

Parameter	Unit		Value		
Reference channel		R.60	R.61	R.61-1	
		TDD	TDD	TDD	
Channel bandwidth	MHz	10	10	10	
Allocated resource blocks		50 ⁴	50 ⁴	39 ⁵	
Uplink-Downlink Configuration (Note 3)		1	1	1	
Allocated subframes per Radio Frame (D+S)		4+2	4+2	4+2	
Allocated subframes per Radio Frame		10	10	10	
Modulation		QPSK	16QAM	16QAM	
Target Coding Rate		1/2	1/2	1/2	
Information Bit Payload					
For Sub-Frames 4 and 9 (Non CSI-RS subframe)	Bits	N/A	N/A	N/A	
For Sub-Frames 4 and 9 (CSI-RS subframe)	Bits	6200	11448	8760	
For Sub-Frames 1,6	Bits	N/A	7736	7480	
For Sub-Frame 5	Bits	N/A	N/A	N/A	
For Sub-Frame 0	Bits	N/A	9528	8760	
Number of Code Blocks per Sub-Frame (Note 6)					
For Sub-Frames 4 and 9 (Non CSI-RS subframe)		N/A	N/A	N/A	
For Sub-Frames 4 and 9 (CSI-RS subframe)		2	2	2	
For Sub-Frames 1,6		N/A	2	2	
For Sub-Frame 5		N/A	N/A	N/A	
For Sub-Frame 0		N/A	2	2	
Binary Channel Bits Per Sub-Frame					
For Sub-Frames 4 and 9 (Non CSI-RS subframe)	Bits	N/A	N/A	N/A	
For Sub-Frames 4 and 9 (CSI-RS subframe)	Bits	11600	23200	18096	
For Sub-Frames 1,6	Bits	N/A	15744	14976	
For Sub-Frame 5	Bits	N/A	N/A	N/A	
For Sub-Frame 0	Bits	N/A	19680	18720	
Max. Throughput averaged over 1 frame	Mbps	1.24	4.7896	4.1240	
UE Category		≥ 1	≥ 2	≥ 1	

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: For R. 60 and R.61, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.
- Note 5: For R. 61-1, 39 resource blocks (RB0–RB20 and RB30–RB47) are allocated in subframe 0. 1, 4, 6 and 9.
- Note 6: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 7: Localized allocation started from RB #0 is applied.

The reference measurement channels in Table A.3.4.3.4-3 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.4-3: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Parameter	Unit	Value
Reference channel		R.64 TDD
Channel bandwidth	MHz	10
Allocated resource blocks (Note 4)		6
Uplink-Downlink Configuration (Note 3)		1
Allocated subframes per Radio Frame (D+S)		4+2
Modulation		QPSK
Target Coding Rate		1/3
Information Bit Payload		
For Sub-Frames 4,9 (non CSI-RS	Bits	504
subframe)		
For Sub-Frames 4,9 (CSI-RS subframe)	Bits	504
For Sub-Frames 1,6		256
For Sub-Frames 0,5	Bits	504
Number of Code Blocks per Sub-Frame		
For Sub-Frames 4,9 (non CSI-RS	Code	1
subframe)	blocks	
For Sub-Frames 4,9 (CSI-RS subframe)	Code	1
	blocks	
For Sub-Frames 1,6	Code	1
	blocks	
For Sub-Frames 0,5	Code	1
	blocks	
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 4,9 (non CSI-RS	Bits	1440
subframe)		
For Sub-Frames 4,9 (CSI-RS subframe)	Bits	1352
For Sub-Frames 1,6		1152
For Sub-Frames 0,5	Bits	1440
Max. Throughput averaged over 1 frame	Mbps	0.2528
UE DL Category		0

Note 1: 2 symbols allocated to PDCCH.

Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]. Note 2:

as per Table 4.2-2 in TS 36.211 [4]. Note 3:

Allocated PRB positions start from $\{9, 10, ..., 9+N-1\}$, where Note 4:

N is the number of allocated resource blocks.

The reference measurement channels in Table A.3.4.3.4-4 apply for verifying demodulation performance for CDMmultiplexed UE specific reference symbols with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.4-4: Fixed Reference Channel for CDM-multiplexed DM RS with four CSI-RS antenna ports

Parameter	Unit	Value
Reference channel		R.69 TDD
Channel bandwidth	MHz	10
Allocated resource blocks		50 (Note 4)
Uplink-Downlink Configuration (Note 3)		1
Allocated subframes per Radio Frame (D+S)		2+2
Modulation		QPSK
Target Coding Rate		
For Sub-Frame 4(CSI-RS subframe)		0.8
For Sub-Frame 9 (non CSI-RS subframe)		0.74
For Sub-Frames 1,6		0.61
Information Bit Payload		
For Sub-Frame 4(CSI-RS subframe)	Bits	7992
For Sub-Frame 9 (non CSI-RS subframe)	Bits	7992
For Sub-Frames 1,6	Bits	4776
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	N/A
Number of Code Blocks per Sub-Frame		
(Note 5)		
For Sub-Frame 4(CSI-RS subframe)		2
For Sub-Frame 9 (non CSI-RS subframe)		2
For Sub-Frames 1,6		1
For Sub-Frame 5		N/A
For Sub-Frame 0		N/A
Binary Channel Bits Per Sub-Frame		
For Sub-Frame 4(CSI-RS subframe)	Bits	10000
For Sub-Frame 9 (non CSI-RS subframe)	Bits	10800
For Sub-Frames 1,6	Bits	7872
For Sub-Frame 5	Bits	N/A
For Sub-Frame 0	Bits	N/A
Max. Throughput averaged over 1 frame	Mbps	2.5536
UE Category		≥ 1
Note 1: 3 symbols allocated to PDCCH.		
Note 2: Reference signal, synchronization signals and	PBCH allocated as per	TS 36.211 [4].

As per Table 4.2-2 in TS 36.211 [4]. Note 3:

50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in the DwPTS portion of sub-frames 1,6. Note 4:

If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is Note 5: attached to each Code Block (otherwise L = 0 Bit).

The reference measurement channels in Table A.3.4.3.4-5 apply for verifying CRI reporting accuracy with two cellspecific antenna ports and four CSI-RS antenna ports.

Table A.3.3.3.4-5: Fixed Reference Channel for four antenna ports (CSI-RS)

	Parameter	Unit	Value			
Reference	e channel		R.44A-1			
			TDD			
	bandwidth	MHz	10			
	ownlink Configuration (Note 3)		2			
Allocated	l resource blocks		50 ⁴			
Allocated	I subframes per Radio Frame		4+2			
Modulation	on		64QAM			
Target Co	oding Rate		1/2			
Informati	on Bit Payload					
For Su	b-Frames (Non CSI-RS subframe)	Bits	18336			
For Sul	b-Frames (CSI-RS subframe)	Bits	N/A			
For Su	b-Frame 5	Bits	N/A			
For Su	b-Frames 1,6		11832			
For Su	b-Frame 0	Bits	14688			
Number	of Code Blocks per Sub-Frame					
(Note 5)	•					
For Su	b-Frames (Non CSI-RS subframe)		3			
For Sul	b-Frames (CSI-RS subframe)		N/A			
For Su	b-Frame 5		N/A			
For Su	b-Frames 1,6		2			
For Su	b-Frame 0		3			
Binary Cl	hannel Bits Per Sub-Frame					
For Su	b-Frames (Non CSI-RS subframe)	Bits	36000			
For Sul	b-Frames (CSI-RS subframe)	Bits	N/A			
For Su	b-Frame 5	Bits	N/A			
For Su	b-Frames 1,6	Bits	23616			
For Su	b-Frame 0	Bits	29520			
Max. Thr	oughput averaged over 1 frame	Mbps	9.336			
UE Cate		•	≥ 2			
Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz						
Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4]						
Note 3:	As per Table 4.2-2 in TS 36.211 [4					
Note 4:	For R.44A-1, 50 resource blocks a					
8, 9 and 41 resource blocks (RB0-RB20 and RB30-RB49) are						
allocated in sub-frame 0 and and the DwPTS portion of sub- frames 1.6.						
Note 5:	If more than one Code Block is pre sequence of L = 24 Bits is attache (otherwise L = 0 Bit)					

A.3.4.3.5 Eight antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.5-1 apply for verifying demodulation performance for CDM-multiplexed UE specific reference symbols with two cell-specific antenna ports and eight CSI-RS antenna ports.

Table A.3.4.3.5-1: Fixed Reference Channel for CDM-multiplexed DM RS with eight CSI-RS antenna ports

		nit Value				
Reference channel		R.50 TDD	R.50-1 TDD	R.50-2 TDD		
Channel bandwidth	MHz	10	10	10		
Allocated resource blocks		50 (Note 4)	50 (Note 4)	50 (Note 6)		
Uplink-Downlink Configuration (Note		1	1	1		
3)						
Allocated subframes per Radio		3+2	3+2	3+2		
Frame (D+S)						
Modulation		QPSK	QPSK	QPSK		
Target Coding Rate		1/3	1/3	1/3		
Information Bit Payload						
For Sub-Frames 4,9 (non CSI-RS	Bits	3624	3624	3624		
subframe)						
For Sub-Frames 4,9 (CSI-RS	Bits	3624	3624	3624		
subframe)						
For Sub-Frames 1,6		2664	2664	3112		
For Sub-Frame 5	Bits	N/A	N/A	N/A		
For Sub-Frame 0	Bits	2984	2984	3368		
Number of Code Blocks per Sub-						
Frame						
(Note 5)						
For Sub-Frames 4,9 (non CSI-RS		1	1	1		
subframe)						
For Sub-Frames 4,9 (CSI-RS		1	1	1		
subframe)						
For Sub-Frames 1,6		1	1	1		
For Sub-Frame 5		N/A	N/A	N/A		
For Sub-Frame 0		1	1	1		
Binary Channel Bits Per Sub-Frame						
For Sub-Frames 4,9 (non CSI-RS	Bits	12000	13200	13200		
subframe)						
For Sub-Frames 4,9 (CSI-RS	Bits	10400	11600	11600		
subframe)						
For Sub-Frames 1,6		7872	7872	8448		
For Sub-Frame 5	Bits	N/A	N/A	N/A		
For Sub-Frame 0	Bits	9840	9840	10560		
Max. Throughput averaged over 1	Mbps	1.556	1.556	1.684		
frame						
UE Category		≥ 1	≥ 1	≥ 1		

Note 1: 2 symbols allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: as per Table 4.2-2 in TS 36.211 [4].

Note 4: 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 6: 50 resource blocks are allocated in sub-frames 4,9 and 47 resource blocks (RB0–RB23 and RB27–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. In sub-frame 0 and the DwPTS portion of sub-frames 1, 6, PDSCH is rate matched around RB22, RB23 and RB27.

The reference measurement channels in Table A.3.4.3.5-2 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and eight CSI-RS antenna ports.

Table A.3.4.3.5-2: Fixed Reference Channel for eight antenna ports (CSI-RS)

Parameter	Unit		Value			
Reference channel		R.45	R.45-1	R.45-2		
		TDD	TDD	TDD		
Channel bandwidth	MHz	10	10	10		
Allocated resource blocks		50 ⁴	39	50 ⁴		
Uplink-Downlink Configuration (Note 3)		1	1	1		
Allocated subframes per Radio Frame		4+2	4+2	4+2		
(D+S)			_			
Allocated subframes per Radio Frame		5	5	10		
Modulation		16QAM	16QAM	64QAM		
Target Coding Rate		1/2	1/2			
Information Bit Payload						
For Sub-Frames 4 and 9	Bits	N/A	N/A	N/A		
(Non CSI-RS subframe) For Sub-Frames 4 and 9	Bits	11448	8760	(402261		
(CSI-RS subframe)	DIIS	11446	8760	[18336]		
	Bits	7726	7480	[44022]		
For Sub-Frames 1,6 For Sub-Frame 5	Bits	7736 N/A	N/A	[11832] N/A		
				,		
For Sub-Frame 0	Bits	9528	8760	[14688]		
Number of Code Blocks per Sub-Frame (Note 5)						
For Sub-Frames 4 and 9		N/A	N/A	N/A		
(Non CSI-RS subframe)						
For Sub-Frames 4 and 9		2	2			
(CSI-RS subframe)						
For Sub-Frames 1,6		2	2			
For Sub-Frame 5		N/A	N/A			
For Sub-Frame 0		2	2			
Binary Channel Bits Per Sub-Frame						
For Sub-Frames 4 and 9	Bits	N/A	N/A			
(Non CSI-RS subframe)						
For Sub-Frames 4 and 9	Bits	22400	17472	[33600]		
(CSI-RS subframe)						
For Sub-Frames 1,6	Bits	15744	14976	[23616]		
For Sub-Frame 5	Bits	N/A	N/A	N/A		
For Sub-Frame 0	Bits	19680	18720	[29520]		
Max. Throughput averaged over 1 frame	Mbps	4.7896	4.1240	7.3296		
UE Category		≥ 2	≥ 1	≥ 2		

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For subframe 1&6, only 2 OFDM symbols are allocated to PDCCH.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: For R.45 and R.45-2, 50 resource blocks are allocated in sub-frames 4,9 and 41 resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6. For R.45-1, 39 resource blocks are allocated in sub-frames 0,4,9 and the DwPTS portion of sub-frames 1,6 (RB0–RB20 and RB30–RB47).

Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits

is attached to each Code Block (otherwise L = 0 Bit). Localized allocation started from RB #0 is applied.

The reference measurement channels in Table A.3.4.3.5-3 apply for verifying CRI reporting accuracy with two cell-specific antenna ports and four CSI-RS antenna ports.

Table A.3.4.3.5-3: Fixed Reference Channel for eight antenna ports (CSI-RS)

	Parameter	Unit	Val	ue		
Referenc	e channel		R.44A-2	R.44A-3		
			TDD	TDD		
	bandwidth	MHz	10	10		
	ownlink Configuration (Note 3)		2	2		
Allocated	resource blocks		50 ⁴	50 ⁴		
Allocated	subframes per Radio Frame		4+2	3+2		
Modulation			64QAM	64QAM		
	oding Rate		1/2	1/2		
	on Bit Payload					
For Sub	o-Frames (Non CSI-RS subframe)	Bits	18336	18336		
	o-Frames (CSI-RS subframe)	Bits	N/A	N/A		
For Sub	o-Frame 5	Bits	N/A	N/A		
For Sub	o-Frames 1,6		11832	11832		
	o-Frame 0	Bits	14688	14688		
Number of	of Code Blocks per Sub-Frame					
(Note 5)						
	o-Frames (Non CSI-RS subframe)		3	3		
For Sub	o-Frames (CSI-RS subframe)		N/A	N/A		
For Sub	o-Frame 5		N/A	N/A		
For Sub	o-Frames 1,6		2	2		
For Sub	o-Frame 0		3	3		
	nannel Bits Per Sub-Frame					
	o-Frames (Non CSI-RS subframe)	Bits	36000	36000		
For Sub	o-Frames (CSI-RS subframe)	Bits	N/A	N/A		
	o-Frame 5	Bits	N/A	N/A		
	o-Frames 1,6	Bits	23616	23616		
	o-Frame 0	Bits	29520	29520		
Max. Thro	oughput averaged over 1 frame	Mbps	9.336	7.5024		
UE Cateo			≥ 2	≥ 2		
Note 1:	2 symbols allocated to PDCCH for BW; 3 symbols allocated to PDCC allocated to PDCCH for 1.4 MHz	H for 5 MHz and	d 3 MHz; 4 sym	nbols		
Note 2:	Reference signal, synchronization 36.211 [4]		CH allocated as	s per TS		
Note 3:	As per Table 4.2-2 in TS 36.211 [4					
Note 4:	For R.44A-2, 50 resource blocks a					
resource blocks (RB0–RB20 and RB30–RB49) are allocated in sub-frame 0						
	and and the DwPTS portion of sub					
	blocks are allocated in sub-frames					
	and RB30-RB49) are allocated in	sub-frame 0 and	and the DwP	TS portion		
	of sub-frames 1,6.		1000			
Note 5:	If more than one Code Block is pre 24 Bits is attached to each Code E			ence of L =		

A.3.4.3.6 Twelve antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.6-1 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and twelve CSI-RS antenna ports.

Table A.3.4.3.6-1: Fixed Reference Channel for twelve antenna ports (CSI-RS)

	Parameter	Unit	Value			
Reference	e channel		R.77 TDD			
	bandwidth	MHz	10			
	resource blocks		50 ⁴			
	ownlink Configuration (Note 3)		1			
	I subframes per Radio Frame		3+2			
(D+S)	r subtraintes per readio i rainte		012			
	subframes per Radio Frame		10			
Modulatio			64QAM			
	oding Rate		1/2			
	on Bit Payload		1/2			
	b-Frames 4 and 9	Bits	N/A			
	SI-RS subframe)	Dito	14/71			
	b-Frames 4 and 9	Bits	16416			
	S subframe)	Dits	10410			
	Frames 1,6	Bits	11832			
	b-Frame 5	Bits	N/A			
	b-Frame 0	Bits	14688			
	of Code Blocks per Sub-Frame	Dita	14000			
(Note 5)	or code blocks per Sub-Frame					
	b-Frames 4 and 9		N/A			
	CSI-RS subframe)		IN/A			
	Frames 4 and 9		3			
	RS subframe)		3			
	Frames 1,6		2			
	b-Frame 5		N/A			
	b-Frame 0		3			
	nannel Bits Per Sub-Frame		3			
	b-Frames 4 and 9	Bits	N/A			
	SI-RS subframe)	Dita	IN/A			
	b-Frames 4 and 9	Bits	32400			
	S subframe)	Dits	32400			
	Frames 1,6	Bits	23616			
	b-Frame 5	Bits	N/A			
	b-Frame 0	Bits	29520			
	oughput averaged over 1 frame	Mbps	7.1184			
UE Cate		IVIDPS	7.1164 ≥ 2			
	2 symbols allocated to PDCCH fo	- 20 MUz 15 N				
Note 1:						
	MHz channel BW; 3 symbols allocated to					
	and 3 MHz; 4 symbols allocated to subframe 1&6, only 2 OFDM sym					
	PDCCH.	DOIS are alloca	ieu io			
Note 2:	Reference signal, synchronization	s cianale and D	BCH.			
NOIG Z.	allocated as per TS 36.211 [4].	i signais and i	DOLL			
Note 3: Note 4:	50 resource blocks are allocated in	 in suh-frames /	1 9 and 41			
11015 7.	resource blocks (RB0–RB20 and					
	in sub-frame 0 and the DwPTS po					
Note 5:	If more than one Code Block is pr					
14016 0.	sequence of L = 24 Bits is attached					
	(otherwise $L = 0$ Bit).	od to each cou	C DIOUR			
Note 6:	Localized allocation started from I	RR #0 is annlia	d			
INUIC U.	Localized allocation Started Holli I	שט אין שיא שא שא האוופ	u.			

A.3.4.3.7 Sixteen antenna ports (CSI-RS)

The reference measurement channels in Table A.3.4.3.7-1 apply for verifying TDD PMI accuracy measurement with two CRS antenna ports and sixteen CSI-RS antenna ports.

Table A.3.4.3.7-1: Fixed Reference Channel for sixteen antenna ports (CSI-RS)

	Parameter	Unit	Value			
Reference	e channel		R.78 TDD			
Channel	bandwidth	MHz	10			
Allocated	resource blocks		50 ⁴			
Uplink-Do	ownlink Configuration (Note 3)		1			
	I subframes per Radio Frame		3+2			
(D+S)	·					
Allocated	I subframes per Radio Frame		10			
Modulation	on		16QAM			
Target Co	oding Rate		1/2			
	on Bit Payload					
	b-Frames 4 and 9	Bits	N/A			
(Non C	SI-RS subframe)					
	b-Frames 4 and 9	Bits	9912			
	S subframe)					
•	Frames 1,6	Bits	7736			
For Su	b-Frame 5	Bits	N/A			
	b-Frame 0	Bits	9528			
	of Code Blocks per Sub-Frame					
(Note 5)	·					
For Su	b-Frames 4 and 9		N/A			
(Non (CSI-RS subframe)					
	Frames 4 and 9		2			
(CSI-F	RS subframe)					
For Sub-	Frames 1,6		2			
	b-Frame 5		N/A			
For Su	b-Frame 0		2			
Binary Cl	nannel Bits Per Sub-Frame					
For Su	b-Frames 4 and 9	Bits	N/A			
	SI-RS subframe)					
_	b-Frames 4 and 9	Bits	20800			
(CSI-R	S subframe)					
	Frames 1,6	Bits	15744			
	b-Frame 5	Bits	N/A			
	b-Frame 0	Bits	19680			
	oughput averaged over 1 frame	Mbps	4.4824			
UE Cate			≥ 2			
Note 1:	2 symbols allocated to PDCCH fo	r 20 MHz. 15 N	MHz and 10			
	MHz channel BW; 3 symbols alloc					
	and 3 MHz; 4 symbols allocated to					
	subframe 1&6, only 2 OFDM sym					
	PDCCH.	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2				
Note 2:	Reference signal, synchronization	n signals and F	BCH			
	allocated as per TS 36.211 [4].	J	-			
Note 3:	As per Table 4.2-2 in TS 36.211 [4].				
Note 4:	50 resource blocks are allocated in		4,9 and 41			
resource blocks (PB0_PB20 and PB30_PB40) are allocated						

resource blocks (RB0-RB20 and RB30-RB49) are allocated in sub-frame 0 and the DwPTS portion of sub-frames 1,6.

If more than one Code Block is present, an additional CRC Note 5: sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
Localized allocation started from RB #0 is applied.

Note 6:

A.3.5 Reference measurement channels for PDCCH/PCFICH performance requirements

A.3.5.1 FDD

Table A.3.5.1-1: Reference Channel FDD

Parameter	Unit					Value				
Reference channel		R.15	R.15-1	R.15-2	R.16	R.16-1	R.16-2	R.16-3	R.16-4	R.17
		FDD	FDD	FDD	FDD	FDD	FDD	FDD	FDD	FDD
Number of		1	2	2	2	2	2	2	2	4
transmitter										
antennas										
Channel bandwidth	MHz	10	10	10	10	10	10	10	10	5
Number of OFDM	symb	2	3	2	2	3	3	1	1	2
symbols for	ols									
PDCCH										
Aggregation level	CCE	8	8	8	4	2	4	2	4	2
DCI Format		1	1	1	2	2	2	2	2	2
Cell ID		0	0	0	0	0	0	0	0	0
Payload (without	Bits	31	31	31	43	43	43	43	43	42
CRC)										

Table A.3.5.1-2: Void

A.3.5.2 TDD

Table A.3.5.2-1: Reference Channel TDD

Parameter	Unit					Value				
Reference channel		R.15 TDD	R.15-1 TDD	R.15-2 TDD	R.16 TDD	R.16-1 TDD	R.16-2 TDD	R.16-3 TDD	R.16-4 TDD	R.17 TDD
Number of transmitter antennas		1	2	2	2	2	2	2	2	4
Channel bandwidth	MHz	10	10	10	10	10	10	10	10	5
Number of OFDM symbols for PDCCH	symb ols	2	3	2	2	3	3	1	1	2
Aggregation level	CCE	8	8	8	4	2	4	2	4	2
DCI Format		1	1	1	2	2	2	2	2	2
Cell ID		0	0	0	0	0	0	0	0	0
Payload (without CRC)	Bits	34	34	34	46	46	46	46	46	45

Table A.3.5.2-2: Void

A.3.5.3 LAA

Table A.3.5.3-1: Reference Channel for FS3 with FDD primary cell

Parameter	Unit	Value
Reference channel		R.3 FS3
Number of transmitter antennas		2
Channel bandwidth	MHz	20
Number of OFDM symbols for PDCCH	symbols	2
Aggregation level	CCE	4
DCI Format		Format 2A
Cell ID		0
Payload (without CRC)	Bits	48

Table A.3.5.3-2: Reference Channel for FS3 with TDD primary cell

Parameter	Unit	Value
Reference channel		R.4 FS3
Number of transmitter antennas		2
Channel bandwidth	MHz	20
Number of OFDM symbols for PDCCH	symbols	2
Aggregation level	CCE	4
DCI Format		Format 2A
Cell ID		0
Payload (without CRC)	Bits	51

A.3.6 Reference measurement channels for PHICH performance requirements

Table A.3.6-1: Reference Channel FDD/TDD

Parameter	Unit		Value						
Reference channel		R.18	R.19	R.19-1	R.20	R.24			
Number of transmitter antennas		1	2	2	4	1			
Channel bandwidth	MHz	10	10	5	5	10			
User roles (Note 1)		W I1 I2	W I1 I2	W I1 I2	W I1 I2	W I1			
Resource allocation (Note 2)		(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1) (0,4)	(0,0) (0,1)			
Power offsets (Note 3)	dB	-4 0 -3	-4 0 -3	-4 0 -3	-4 0 -3	+3 0			
Payload (Note 4)		ARR	ARR	ARR	ARR	AR			

Note 1: W=wanted user, I1=interfering user 1, I2=interfering user 2.

Note 2: The resource allocation per user is given as (N_group_PHICH, N_seq_PHICH).

Note 3: The power offsets (per user) represent the difference of the power of BPSK modulated symbol per PHICH relative to the first interfering user.

Note 4: A=fixed ACK, R=random ACK/NACK.

A.3.7 Reference measurement channels for PBCH performance requirements

Table A.3.7-1: Reference Channel FDD/TDD

Parameter	Unit	Value							
Reference channel		R.21	R.22	R.23					
Number of transmitter antennas		1	2	4					
Channel bandwidth	MHz	1.4	1.4	1.4					
Modulation		QPSK	QPSK	QPSK					
Target coding rate		40/1920	40/1920	40/1920					
Payload (without CRC)	Bits	24	24	24					

A.3.8 Reference measurement channels for MBMS performance requirements

A.3.8.1 FDD

Table A.3.8.1-1: Fixed Reference Channel QPSK R=1/3

Parameter			Р	МСН			
	Unit			Val	ue		
Reference channel		R.40 FDD			R.37 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6			50		
Allocated subframes per Radio		6			6		
Frame (Note 1)							
Modulation		QPSK			QPSK		
Target Coding Rate		1/3			1/3		
Information Bit Payload (Note 2)							
For Sub-Frames 1,2,3,6,7,8	Bits	408			3624		
For Sub-Frames 0,4,5,9	Bits	N/A			N/A		
Number of Code Blocks per		1			1		
Subframe (Note 3)							
Binary Channel Bits Per Subframe							
For Sub-Frames 1,2,3,6,7,8	Bits	1224			10200		
For Sub-Frames 0,4,5,9	Bits	N/A			N/A		
MBMS UE Category		≥ 1			≥ 1		

Note 1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS

Note 2: 2 OFDM symbols are reserved for PDCCH; and reference signal allocated as per TS

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.8.1-2: Fixed Reference Channel 16QAM R=1/2

Parameter				PMC	CH		
	Unit				Value		
Reference channel					R.38 FDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Allocated subframes per Radio Frame (Note 1)					6		
Modulation					16QAM		
Target Coding Rate					1/2		
Information Bit Payload (Note 2)							
For Sub-Frames 1,2,3,6,7,8	Bits				9912		
For Sub-Frames 0,4,5,9	Bits				N/A		
Number of Code Blocks per Subframe (Note 3)					2		
Binary Channel Bits Per Subframe							
For Sub-Frames 1,2,3,6,7,8	Bits				20400		
For Sub-Frames 0,4,5,9	Bits				N/A		
MBMS UE Category					≥ 1		

Note 1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.

Note 2: 2 OFDM symbols are reserved for PDCCH; and reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.8.1-3: Fixed Reference Channel 64QAM R=2/3

Parameter	PMCH										
	Unit			Va	alue						
Reference channel				R.39-1 FDD	R.39 FDD						
Channel bandwidth	MHz	1.4	3	5	10	15	20				
Allocated resource blocks				25	50						
Allocated subframes per Radio Frame(Note1)				6	6						
Modulation				64QAM	64QAM						
Target Coding Rate				2/3	2/3						
Information Bit Payload (Note 2)							•				
For Sub-Frames 1,2,3,6,7,8	Bits			9912	19848						
For Sub-Frames 0,4,5,9	Bits			N/A	N/A						
Number of Code Blocks per Sub-Frame (Note 3)				2	4						
Binary Channel Bits Per Subframe											
For Sub-Frames 1,2,3,6,7,8	Bits			15300	30600						
For Sub-Frames 0,4,5,9	Bits			N/A	N/A						
MBMS UE Category				≥ 1	≥ 2						

Note 1: For FDD mode, up to 6 subframes (#1/2/3/6/7/8) are available for MBMS, in line with TS 36.331.

Note 2: 2 OFDM symbols are reserved for PDCCH; and reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

A.3.8.2 TDD

Table A.3.8.2-1: Fixed Reference Channel QPSK R=1/3

Parameter				РМСН			
	Unit			Va	lue		
Reference channel		R.40 TDD			R.37 TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks		6			50		
Uplink-Downlink Configuration(Note 1)		5			5		
Allocated subframes per Radio Frame		5			5		
Modulation		QPSK			QPSK		
Target Coding Rate		1/3			1/3		
Information Bit Payload (Note 2)							
For Sub-Frames 3,4,7,8,9	Bits	408			3624		
For Sub-Frames 0,1,2,5,6	Bits	N/A			N/A		
Number of Code Blocks per Subframe		1			1		
(Note 3)							
Binary Channel Bits Per Subframe							
For Sub-Frames 3,4,7,8,9	Bits	1224			10200		
For Sub-Frames 0,1,2,5,6	Bits	N/A			N/A		
MBMS UE Category		≥ 1		·	≥ 1		

Note 1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.

Note 2: 2 OFDM symbols are reserved for PDCCH; reference signal allocated as per TS 36.211.

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.3.8.2-2: Fixed Reference Channel 16QAM R=1/2

Parameter				PMC	CH		
	Unit				Value		
Reference channel					R.38 TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks					50		
Uplink-Downlink Configuration(Note 1)					5		
Allocated subframes per Radio Frame					5		
Modulation					16QAM		
Target Coding Rate					1/2		
Information Bit Payload (Note 2)							
For Sub-Frames 3,4,7,8,9	Bits				9912		
For Sub-Frames 0,1,2,5,6	Bits				N/A		
Number of Code Blocks per Subframe (Note 3)					2		
Binary Channel Bits Per Subframe							
For Sub-Frames 3,4,7,8,9	Bits				20400		
For Sub-Frames 0,1,2,5,6	Bits				N/A		
MBMS UE Category					≥ 1		

Note 1: For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 subframes (#3/4/7/8/9) are available for MBMS.

Note 2: 2 OFDM symbols are reserved for PDCCH; reference signal allocated as per TS 36.211. Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is

attached to each Code Block (otherwise L = 0 Bit).

Table A.3.8.2-3: Fixed Reference Channel 64QAM R=2/3

Parameter				PMCH			
	Unit			Val	ue		
Reference channel				R.39-1TDD	R.39 TDD		
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Uplink-Downlink Configuration(Note 1)				5	5		
Allocated subframes per Radio Frame				5	5		
Modulation				64QAM	64QAM		
Target Coding Rate				2/3	2/3		
Information Bit Payload (Note 2)							
For Sub-Frames 3,4,7,8,9	Bits			9912	19848		
For Sub-Frames 0,1,2,5,6	Bits			N/A	N/A		
Number of Code Blocks per Sub-Frame (Note 3)				2	4		
Binary Channel Bits Per Subframe							
For Sub-Frames 3,4,7,8,9	Bits			15300	30600		
For Sub-Frames 0,1,2,5,6	Bits			N/A	N/A		
MBMS UE Category				≥ 1	≥ 2		

For TDD mode, in line with TS 36.331, Uplink-Downlink Configuration 5 is proposed, up to 5 Note 1: subframes (#3/4/7/8/9) are available for MBMS.
2 OFDM symbols are reserved for PDCCH; reference signal allocated as per TS 36.211.

Note 2:

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

A.3.9 Reference measurement channels for sustained downlink data rate provided by lower layers

A.3.9.1 FDD

Table A.3.9.1-1: Fixed Reference Channel for sustained data-rate test (FDD 64QAM)

Parameter	Unit				Va	alue			
Reference channel		R.31-1	R.31-2	R.31-3	R.31-	R.31-3C	R.31-4	R.31-4B	R.31-5
		FDD	FDD	FDD	3A FDD	FDD	FDD	FDD	FDD
Channel bandwidth	MHz	10	10	20	10	15	20	15	15
Allocated resource blocks (Note 8)		Note 5	Note 6	Note 7	Note 6	Note 10	Note 7	Note 11	Note 9
Allocated subframes per Radio Frame		10	10	10	10	10	10	10	10
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Coding Rate									
For Sub-Frame 1,2,3,4,6,7,8,9,		0.40	0.59	0.59	0.85	0.87	0.88	0.85	0.85
For Sub-Frame 5		0.40	0.64	0.62	0.89	0.88	0.87	0.87	0.91
For Sub-Frame 0		0.40	0.63	0.61	0.90	0.91	0.90	0.88	0.88
Information Bit Payload (Note 8)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10296	25456	51024	36696	51024	75376	55056	55056
For Sub-Frame 5	Bits	10296	25456	51024	35160	51024	71112	52752	52752
For Sub-Frame 0	Bits	10296	25456	51024	36696	51024	75376	55056	55056
Number of Code Blocks									
(Notes 3 and 8)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2	5	9	6	9	13	9	9
For Sub-Frame 5	Bits	2	5	9	6	9	12	9	9
For Sub-Frame 0	Bits	2	5	9	6	9	13	9	9
Binary Channel Bits (Note 8)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	26100	43200	86400	43200	58752	86400	64800	64800
For Sub-Frame 5	Bits	26100	39744	82080	39744	57888	82080	60480	60480
For Sub-Frame 0	Bits	26100	40752	83952	40752	56304	83952	62352	62352
Number of layers		1	2	2	2	2	2	2	2
Max. Throughput averaged over 1 frame (Note 8)	Mbps	10.296	25.456	51.024	36.542	51.024	74.950	54.826	54.826
UE Categories		≥ 1	≥ 2	≥ 2	≥ 2	≥ 3	≥ 3	≥ 4	≥ 3

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 4: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 5: Resource blocks n_{PRB} = 6..14,30..49 are allocated for the user data in all sub-frames.
- Note 6: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Given per component carrier per codeword.
- Note 9: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 10: Resource blocks n_{PRB} = 4..71 are allocated for the user data in sub-frames 0,1,2,3,4,5,6,7,8,9.
- Note 11: Resource blocks $n_{PRB} = 4..74$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..74$ in sub-frames 0,1,2,3,4,6,7,8,9.

Table A.3.9.1-2: Fixed Reference Channel for sustained data-rate test (FDD 64QAM)

Parameter	Unit	Value							
Reference channel		R.31-6							
		FDD							
Channel bandwidth	MHz	5	·						
Allocated resource blocks (Note 5)		Note 4							
Allocated subframes per Radio Frame		9							
Modulation		64QAM							
Coding Rate									
For Sub-Frame 1,2,3,4,6,7,8,9,		0.85	1						
For Sub-Frame 5		N/A	1						
For Sub-Frame 0		0.83	1						
Information Bit Payload (Note 5)			1						
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	18336	1						
For Sub-Frame 5	Bits	N/A	1						
For Sub-Frame 0	Bits	15840	1						
Number of Code Blocks			1						
(Notes 3 and 5)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	3	1						
For Sub-Frame 5	Bits	N/A							
For Sub-Frame 0	Bits	3							
Binary Channel Bits (Note 5)									
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	21600	1						
For Sub-Frame 5	Bits	N/A	1						
For Sub-Frame 0	Bits	19152	1						
Number of layers		2							
Max. Throughput averaged over 1 frame (Note 5)	Mbps	17.837							
UE Categories		≥ 2							

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)
- Note 4: Resource blocks $n_{PRB} = 0..24$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 5: Given per component carrier per codeword.
- Note 6: Ng=1/6.
- Note 7: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Resource blocks $n_{PRB} = 4..74$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..74$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 9: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,1,2,3,4,6,7,8,9.

Table A.3.9.1-3: Fixed Reference Channel for sustained data-rate test (FDD 256QAM)

Parameter	Unit				Value	
Reference channel		R.68	R.68-1	R.68-2	R.68-3	
		FDD	FDD	FDD	FDD	
Channel bandwidth	MHz	20	15	10	5	
Allocated resource blocks (Note 4)		Note 5	Note 6	Note 7	Note 8	
Allocated subframes per Radio Frame		10	10	10	10	
Modulation		256QAM	256QAM	256QAM	256QAM	
Coding Rate						
For Sub-Frames 3,4,8,9		0.85	0.88	0.85	0.85	
For Sub-Frames 1,2,6,7		0.74	0.74	0.74	0.77	
For Sub-Frame 5		0.75	0.77	0.77	0.79	
For Sub-Frame 0		0.76	0.77	0.78	0.84	
Information Bit Payload (Note 4)						
For Sub-Frames 3,4,8,9	Bits	97896	75376	48936	24496	
For Sub-Frames 1,2,6,7		84760	63776	42368	21384	
For Sub-Frame 5	Bits	81176	61664	40576	19848	
For Sub-Frame 0	Bits	84760	63776	42368	21384	
Number of Code Blocks (Notes 3 and 4)						
For Sub-Frames 3,4,8,9	Bits	16	13	8	4	
For Sub-Frames 1,2,6,7		14	11	7	4	
For Sub-Frame 5	Bits	14	11	7	4	
For Sub-Frame 0	Bits	14	11	7	4	
Binary Channel Bits (Note 4)						
For Sub-Frames 3,4,8,9	Bits	115200	86400	57600	28800	
For Sub-Frames 1,2,6,7		115200	86400	57600	28800	
For Sub-Frame 5	Bits	109440	80640	52992	25344	
For Sub-Frame 0	Bits	111936	83136	54336	25536	
Number of layers		2	2	2	2	
Max. Throughput averaged over 1 frame (Note 4)	Mbp s	89.656	68.205	44.816	22.475	
UE Categories		11-12	11-12	11-12	11-12	
UE DL Categories		≥ 11	≥ 11	≥ 11	≥ 11	

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 4: Given per component carrier per codeword.
- Note 5: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 6: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Resource blocks $n_{PRB} = 2..24$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..24$ in sub-frames 0,1,2,3,4,6,7,8,9.

A.3.9.2 TDD

Table A.3.9.2-1: Fixed Reference Channel for sustained data-rate test (TDD 64QAM)

Parameter	Unit					Value				
Reference channel	0	R.31-1	R.31-2	R.31-3	R.31-	R.31-4	R.31-	R.31-5	R.31-	R.31-6
Telefence charmer		TDD	TDD	TDD	3A	TDD	4A	TDD	5A	TDD
		155	100	100	TDD	100	TDD	'55	TDD	100
Channel bandwidth	MHz	10	10	20	15	20	20	15	15	10
Allocated resource blocks	1411.12	Note 6	Note 7	Note 8	Note 9	Note 8	Note 8	Note	Note	Note 7
7 modatod rocodiroc bioone		14010 0	110107	11010 0	14010 0	14010 0	14010 0	11	11	11010 7
Uplink-Downlink		5	5	5	1	1	2	1	2	1
Configuration (Note 3)					·	·	_		_	
Number of HARQ Processes	Proce	15	15	15	7	7	10	7	10	7
per component carrier	sses						. •			•
Allocated subframes per		8+1	8+1	8+1	4	4	6+2	4	6+2	4
Radio Frame (D+S)					-	-				
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Target Coding Rate										
For Sub-Frames 4,9		0.40	0.59	0.59	0.87	0.88	0.88	0.85	0.85	0.85
For Sub-Frames 3,8		0.40	0.59	0.59	N/A	N/A	0.88	N/A	0.85	N/A
For Sub-Frame 7		0.40	0.59	0.59	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frames 0		0.40	0.62	0.61	0.90	0.90	0.90	0.88	0.88	0.90
For Sub-Frames 1		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frames 5		0.40	0.64	0.62	0.88	0.87	0.87	0.87	0.87	0.88
For Sub-Frames 6		0.40	0.60	0.60	N/A	N/A	N/A	N/A	N/A	N/A
Information Bit Payload					-	-	-	-	-	
For Sub-Frames 4,9	Bits	10296	25456	51024	51024	75376	75376	55056	55056	36696
For Sub-Frames 3,8	Bits	10296	25456	51024	0	0	75376	0	55056	0
For Sub-Frame 7	Bits	10296	25456	51024	0	0	N/A	0	N/A	0
For Sub-Frame 0	Bits	10296	25456	51024	51024	75376	75376	55056	55056	36696
For Sub-Frame 1	Bits	0	0	0	0	0	0	0	0	0
For Sub-Frame 5	Bits	10296	25456	51024	51024	71112	71112	52752	52752	35160
For Sub-Frame 6	Bits	10296	25456	51024	0	0	0	0	0	0
Number of Code Blocks per					-	-	-	-	-	
Sub-Frame										
(Note 4)										
For Sub-Frames 4,9		2	5	9	9	13	13	9	9	6
For Sub-Frames 3,8		2	5	9	N/A	N/A	13	N/A	9	N/A
For Sub-Frame 7		2	5	9	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 0		2	5	9	9	13	13	9	9	6
For Sub-Frame 1		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5		2	5	9	9	12	12	9	9	6
For Sub-Frame 6	Bits	2	5	9	n/a	N/A	N/A	N/A	N/A	N/A
Binary Channel Bits Per Sub-										
Frame										
For Sub-Frames 4,9	Bits	26100	43200	86400	58752	86400	86400	64800	64800	43200
For Sub-Frames 3,8	Bits	26100	43200	86400	0	0	86400	0	64800	0
For Sub-Frame 7	Bits	26100	43200	86400	0	0	86400	0	64800	0
For Sub-Frame 0	Bits	26100	41184	84384	56736	84384	84384	62784	62784	41184
For Sub-Frame 1	Bits	0	0	0	0	0	0	0	0	0
For Sub-Frame 5	Bits	26100	40176	82512	58320	82512	82512	60912	60912	40176
For Sub-Frame 6	Bits	26100	42768	85968	N/A	N/A	0	N/A	0	N/A
Number of layers		1	2	2	2	2	2	2	2	2
Max. Throughput averaged	Mbps	8.237	20.365	40.819	20.409	29.724	52.337	25.330	38.309	14.525
over 1 frame (Note 10)										
UE Category		≥ 1	≥ 2	≥ 2	≥ 2	≥ 3	≥ 3	≥ 3	≥ 3	≥ 2
Note 1: 1 symbol allocated to	PDCCH	I for all test	s.							

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.

Note 6: Resource blocks n_{PRB} = 6..14,30..49 are allocated for the user data in all subframes.

Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in the available downlink sub-frames according to uplink downlink configurations used .

Note 8:	Resource blocks npre = 499 are allocated for the user data in sub-frame 5, and resource blocks npre = 099 in sub-
	frames 0,3,4,6,7,8,9.

- Note 9: Resource blocks $n_{PRB} = 4..71$ are allocated for the user data in all sub-frames
- Note10:
- Given per component carrier per codeword.

 Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in other Note11: downlink sub-frames.

Table A.3.9.2-1A: Fixed Reference Channel for sustained data-rate test (TDD 64QAM)

Parameter	Unit	Value								
Reference channel										
Channel bandwidth	MHz									
Allocated resource blocks										
Uplink-Downlink										
Configuration (Note 3)										
Number of HARQ Processes	Proce									
per component carrier	sses									
Allocated subframes per	-									
Radio Frame (D+S)										
Modulation										
Target Coding Rate										
For Sub-Frames 4,9										
For Sub-Frames 3,8										
For Sub-Frame 7										
For Sub-Frames 0										
For Sub-Frames 1	†									
For Sub-Frames 5	1									
For Sub-Frames 6	1									
Information Bit Payload	1									
For Sub-Frames 4,9	Bits									
For Sub-Frames 3,8	Bits									
For Sub-Frame 7	Bits									
For Sub-Frame 0	Bits									
For Sub-Frame 1	Bits									
For Sub-Frame 5	Bits									
For Sub-Frame 6	Bits									
Number of Code Blocks per	Dita									
Sub-Frame										
(Note 4)										
For Sub-Frames 4,9										
For Sub-Frames 3,8										
For Sub-Frame 7										
For Sub-Frame 0										
For Sub-Frame 1										
For Sub-Frame 5										
For Sub-Frame 6	Bits									
Binary Channel Bits Per Sub-	Dito									
Frame										
For Sub-Frames 4,9	Bits									
For Sub-Frames 3,8	Bits									
For Sub-Frame 7	Bits									
For Sub-Frame 0	Bits						1			
For Sub-Frame 1	Bits						1			
For Sub-Frame 5	Bits									
For Sub-Frame 6	Bits									
Number of layers	טונט			+		 				
Max. Throughput averaged	Mbps									
over 1 frame (Note 10)	1,1,2,20									
UE Category	†			1						
Note 1: 1 symbol allocated t		for all too	rc	1	1	I	1	1	I	

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].
- Note 3: As per Table 4.2-2 in TS 36.211 [4].
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 6: Resource blocks n_{PRB} = 6..14,30..49 are allocated for the user data in all subframes.
- Note 7: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in the available downlink sub-frames according to uplink downlink configurations used .
- Note 8: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,3,4,6,7,8,9.
- Note 9: Resource blocks n_{PRB} = 4..71 are allocated for the user data in all sub-frames
- Note10: Given per component carrier per codeword.
- Note11: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74

in other downlink sub-frames.

Note 12: Resource blocks nPRB = 4..99 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..99 in other downlink sub-frames.

Table A.3.9.2-2: Fixed Reference Channel for sustained data-rate test (TDD 256QAM)

Parameter	Unit			Va	lue		
Reference channel		R.68	R.68-1	R.68-2	R.68-3	R.68-4	
		TDD	TDD	TDD	TDD	TDD	
Channel bandwidth	MHz	20	15	10	20	15	
Allocated resource blocks	PRB	Note 6	Note 7	Note 8	Note 6	Note 7	
Uplink-Downlink Configuration (Note 3)		1	1	1	[2]	[2]	
Number of HARQ Processes per	Proces	7	7	7	[10]	[10]	
component carrier	ses						
Allocated subframes per Radio Frame		4+2	4+2	4+2	[6+2]	[6+2]	
(D+S)							
Modulation		256QAM	256QAM	256QAM	256QAM	256QAM	
Target Coding Rate							
For Sub-Frame 0		0.76	0.77	0.78	0.76	0.77	
For Sub-Frame 1		N/A	N/A	N/A	N/A	N/A	
For Sub-Frames 3		N/A	N/A	N/A	0.74	0.79	
For Sub-Frames 4		0.74	0.79	0.74	0.74	0.79	
For Sub-Frame 5		0.74	0.76	0.76	0.74	0.76	
For Sub-Frame 6		N/A	N/A	N/A	[N/A]	[N/A]	
For Sub-Frame 7		N/A	N/A	N/A	[N/A]	[N/A]	
For Sub-Frames 8		N/A	N/A	N/A	0.85	0.88	
For Sub-Frames 9		0.85	0.88	0.85	0.85	0.88	
Information Bit Payload							
For Sub-Frame 0	Bits	84760	63776	42368	84760	63776	
For Sub-Frame 1	Bits	0	0	0	0	0	
For Sub-Frames 3	Bits	N/A	N/A	N/A	84760	63776	
For Sub-Frames 4	Bits	84760	63776	42368	84760	63776	
For Sub-Frame 5	Bits	81176	61664	40576	81176	61664	
For Sub-Frame 6	Bits	0	0	0	[0]	[0]	
For Sub-Frame 7	2.10	N/A	N/A	N/A	[N/A]	[N/A]	
For Sub-Frames 8	Bits	N/A	N/A	N/A	97896	75376	
For Sub-Frames 9	Bits	97896	75376	48936	97896	75376	
Number of Code Blocks per Sub-Frame					0.000		
(Note 4)							
For Sub-Frame 0		14	11	7	14	11	
For Sub-Frame 1		N/A	N/A	N/A	N/A	N/A	
For Sub-Frames 3		N/A	N/A	N/A	14	11	
For Sub-Frames 4		14	11	7	14	11	
For Sub-Frame 5		14	11	7	14	11	
For Sub-Frame 6		N/A	N/A	N/A	[N/A]	[11]	
For Sub-Frame 7		N/A	N/A	N/A	[N/A]	[11]	
For Sub-Frames 8		N/A	N/A	N/A	16	13	
For Sub-Frames 9		16	13	8	16	13	
Binary Channel Bits Per Sub-Frame		-	_	_			
For Sub-Frame 0	Bits	112512	83712	54912	112512	83712	
For Sub-Frame 1	Bits	0	0	0	0	0	
For Sub-Frames 3	Bits	N/A	N/A	N/A	115200	86400	
For Sub-Frames 4	Bits	115200	86400	57600	115200	86400	
For Sub-Frame 5		110016	81216	53568	110016	81216	
For Sub-Frame 6	Bits	0	0	0	[0]	[0]	
For Sub-Frame 7	1	N/A	N/A	N/A	[N/A]	[N/A]	
For Sub-Frames 8	Bits	N/A	N/A	N/A	115200	86400	
For Sub-Frames 9	Bits	115200	86400	57600	115200	86400	
Number of layers		2	2	2	2	2	
Max. Throughput averaged over 1 frame	Mbps	34.859	26.459	17.425	[53.125]	[40.374]	
(Note 5)		2			[221.20]	[
UE Categories		11-12	11-12	11-12	11-12	11-12	
UE DL Categories		≥ 11	≥ 11	≥ 11	≥ 11	≥ 11	
Note 1: 1 symbol allocated to PDCCH for	r all tacts			ı			

Note 1: 1 symbol allocated to PDCCH for all tests.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Given per component carrier per codeword.

Note 6: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in other

downlink sub-frames.

Note 7: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in other downlink sub-frames.

Note 8: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in the available downlink sub-frames according to uplink downlink configurations used.

Table A.3.9.3-: Fixed Reference Channel for sustained data-rate test (TDD 256QAM)

Parameter	Unit		Va	lue		
Reference channel						
Channel bandwidth	MHz					
Allocated resource blocks	PRB					
Uplink-Downlink Configuration (Note 3)						
Number of HARQ Processes per	Proces					
component carrier	ses					
Allocated subframes per Radio Frame						
(D+S)						
Modulation						
Target Coding Rate						
For Sub-Frame 0						
For Sub-Frame 1						
For Sub-Frames 3						
For Sub-Frames 4						
For Sub-Frame 5						
For Sub-Frame 6						
For Sub-Frame 7						
For Sub-Frames 8 For Sub-Frames 9						
Information Bit Payload						
For Sub-Frame 0	Bits					
For Sub-Frame 1	Bits					
For Sub-Frames 3	Bits					
For Sub-Frames 4	Bits					
For Sub-Frame 5	Bits					
For Sub-Frame 6	Bits					
For Sub-Frame 7	Dito					
For Sub-Frames 8	Bits					
For Sub-Frames 9	Bits					
Number of Code Blocks per Sub-Frame						
(Note 4)						
For Sub-Frame 0						
For Sub-Frame 1						
For Sub-Frames 3						
For Sub-Frames 4						
For Sub-Frame 5						
For Sub-Frame 6						
For Sub-Frame 7						
For Sub-Frames 8						
For Sub-Frames 9						
Binary Channel Bits Per Sub-Frame						
For Sub-Frame 0	Bits					
For Sub-Frame 1	Bits					
For Sub-Frames 3	Bits					
For Sub-Frames 4	Bits					
For Sub-Frame 5	D.,					
For Sub-Frame 6 For Sub-Frame 7	Bits					
	Dito					
For Sub-Frames 8 For Sub-Frames 9	Bits Bits					
Number of layers	DIIS					
Max. Throughput averaged over 1 frame	Mbps		+			
(Note 5)	INIDA2					
UE Categories	-					
UE DL Categories						
Note 1: 1 symbol allocated to PDCCH for	r all tests	<u> </u>	1	1	I	I
i i i i i i i i i i i i i i i i i i i						

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Given per component carrier per codeword.

Note 6: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in other downlink sub-frames.

- Note 7: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in other downlink sub-frames.
- Note 8: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in the available downlink sub-frames according to uplink downlink configurations used.

A.3.9.3 FDD (EPDCCH scheduling)

Table A.3.9.3-1: Fixed Reference Channel for sustained data-rate test with EPDCCH scheduling (FDD)

Parameter	Unit				Value			
Reference channel		R.31E-	R.31E-	R.31E-	R.31E-	R.31E-	R.31E-	R.31E-
		1 FDD	2 FDD	3 FDD	3A FDD	3C FDD	4 FDD	4B FDD
Channel bandwidth	MHz	10	10	20	10	15	20	15
Allocated resource blocks (Note 8)		Note 5	Note 6	Note 7	Note 6	Note 9	Note 7	Note 10
Allocated subframes per Radio		10	10	10	10	10	10	10
Frame								
Modulation		64QAM	64QAM	64QAM	64QAM	64QAM	64QAM	64QAM
Coding Rate								
(subframes with PDCCH USS								
monitoring)								
For Sub-Frame 1,2,3,4,6,7,8,9,		0.3972	0.5926	0.5933	0.8533	0.8725	0.8763	0.8533
For Sub-Frame 5		0.3972	0.6441	0.6246	0.8889	0.8855	0.8702	0.8762
For Sub-Frame 0		0.3972	0.6282	0.6106	0.9046	0.9105	0.9018	0.8868
Coding Rate								
(subframes with EPDCCH USS								
monitoring)								
For Sub-Frame 1,2,3,4,6,7,8,9,		0.4114	0.6047	0.5993	0.8707	0.8855	0.8851	0.8649
For Sub-Frame 5		0.4114	0.6584	0.6312	0.9086	0.8990	0.8794	0.8889
For Sub-Frame 0		0.4114	0.6418	0.6170	0.9242	0.9246	0.9112	0.8993
Information Bit Payload (Note 8)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	10296	25456	51024	36696	51024	75376	55056
For Sub-Frame 5	Bits	10296	25456	51024	35160	51024	71112	52752
For Sub-Frame 0	Bits	10296	25456	51024	36696	51024	75376	55056
Number of Code Blocks								
(Notes 3 and 8)	D.,						40	
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2	5	9	6	9	13	9
For Sub-Frame 5	Bits	2	5	9	6	9	12	9
For Sub-Frame 0	Bits	2	5	9	6	9	13	9
Binary Channel Bits (Note 8)								
(subframes with PDCCH USS								
monitoring) For Sub-Frames 1,2,3,4,6,7,8,9	D:4-a	26100	43200	86400	43200	58752	86400	64800
For Sub-Frames 1,2,3,4,6,7,8,9 For Sub-Frame 5	Bits		39744	82080	39744		82080	60480
	Bits	26100				57888		
For Sub-Frame 0	Bits	26100	40752	83952	40752	56304	83952	62352
Binary Channel Bits (Note 8) (subframes with EPDCCH USS								
monitoring)								
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	25200	42336	85536	42336	57888	85536	63936
For Sub-Frame 5	Bits	25200	38880	81216	38880	57024	81216	59616
For Sub-Frame 0	Bits	25200	39888	83088	39888	55440	83088	
Number of layers	DIIS	25200 1	2	2	39888	2		61488 2
Max. Throughput averaged over 1	Mhnc	10.296	25.456	51.024	36.542	51.024	2 74.950	54.826
frame (Note 8)	Mbps	10.290	25.456	31.024	30.342	31.024	74.900	04.020
UE Categories		≥ 1	≥ 2	≥ 2	≥ 2	≥ 3	≥ 3	≥ 4
or categories	l	<	_ < _		< Z	_ ≤ ຽ	_ ≤ 3	< 4

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211.
- Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 4: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 5: Resource blocks n_{PRB} = 6..14,30..49 are allocated for the user data in all sub-frames.
- Note 6: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Given per component carrier per codeword.

Note 9: Resource blocks $n_{PRB} = 4..71$ are allocated for the user data in sub-frames 0,1,2,3,4,5,6,7,8,9.

Note 10: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.

A.3.9.4 TDD (EPDCCH scheduling)

Table A.3.9.4-1: Fixed Reference Channel for sustained data-rate with EPDCCH scheduling (TDD)

Parameter	Unit			Value		
Reference channel		R.31E-1	R.31E-2	R.31E-3	R.31E-3A	R.31E-4
		TDD	TDD	TDD	TDD	TDD
Channel bandwidth	MHz	10	10	20	15	20
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9	Note 8
Uplink-Downlink Configuration (Note 3)		5	5	5	1	1
Number of HARQ Processes per component carrier	Processes	15	15	15	7	7
Allocated subframes per Radio Frame (D+S)		8+1	8+1	8+1	4	4
Coding Rate (subframes with PDCCH USS monitoring)						
For Sub-Frames 4,9		0.3972	0.5926	0.5933	0.8725	0.8763
For Sub-Frames 3,7,8		0.3972	0.5926	0.5933	N/A	N/A
For Sub-Frames 1		N/A	N/A	N/A	N/A	N/A
For Sub-Frames 5		0.3972	0.6372	0.6213	0.8790	0.8656
For Sub-Frames 6		0.3972	0.5986	0.5963	N/A	N/A
For Sub-Frames 0		0.3972	0.6216	0.6075	0.9036	0.8972
Coding Rate (subframes with EPDCCH USS monitoring)						
For Sub-Frames 4,9		0.4114	0.6047	0.5993	0.8856	0.8851
For Sub-Frames 3,7,8		0.4114	0.6047	0.5993	N/A	N/A
For Sub-Frames 1		N/A	N/A	N/A	N/A	N/A
For Sub-Frames 5		0.4114	0.6512	0.6279	0.8922	0.8748
For Sub-Frames 6		0.4114	0.6109	0.6024	N/A	N/A
For Sub-Frames 0		0.4114	0.6349	0.6138	0.9175	0.9065
Information Bit Payload						
For Sub-Frames 4,9	Bits	10296	25456	51024	51024	75376
For Sub-Frames 3,7,8	Bits	10296	25456	51024	N/A	N/A
For Sub-Frame 1	Bits	0	0	0	N/A	N/A
For Sub-Frame 5	Bits	10296	25456	51024	51024	71112
For Sub-Frame 6	Bits	10296	25456	51024	N/A	N/A
For Sub-Frame 0	Bits	10296	25456	51024	51024	75376
Number of Code Blocks per Sub- Frame (Note 4)						
For Sub-Frames 4,9		2	5	9	9	13
For Sub-Frames 3,7,8		2	5	9	N/A	N/A
For Sub-Frame 1		N/A	N/A	N/A	N/A	N/A
For Sub-Frame 5		2	5	9	9	12
For Sub-Frame 6	Bits	2	5	9	N/A	N/A
For Sub-Frame 0		2	5	9	9	13
Binary Channel Bits per Sub-Frame (subframes with PDCCH USS monitoring)						
For Sub-Frames 4,9	Bits	26100	43200	86400	58752	86400
For Sub-Frames 3,7,8	Bits	26100	43200	86400	N/A	N/A
For Sub-Frame 1	Bits	0	0	0	N/A	N/A
For Sub-Frame 5	Bits	26100	40176	82512	58320	82512
For Sub-Frame 6	Bits	26100	42768	85968	N/A	N/A
For Sub-Frame 0	Bits	26100	41184	84384	56736	84384
Binary Channel Bits per Sub-Frame (subframes with EPDCCH USS monitoring)						

For Sub-Frames 4,9	Bits	25200	42336	85536	57888	85536
For Sub-Frames 3,7,8	Bits	25200	42336	85536	N/A	N/A
For Sub-Frame 1	Bits	0	0	0	N/A	N/A
For Sub-Frame 5	Bits	25200	39312	81648	57456	81648
For Sub-Frame 6	Bits	25200	41904	85104	N/A	N/A
For Sub-Frame 0	Bits	25200	40320	83520	55872	83520
Number of layers		1	2	2	2	2
Max. Throughput averaged over 1 frame (Note 10)	Mbps	8.237	20.365	40.819	20.409	29.724
UE Category		≥1	≥ 2	≥ 2	≥ 2	≥ 3

Note 1: 1 symbol allocated to PDCCH for all tests.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: As per Table 4.2-2 in TS 36.211 [4].

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.

Note 6: Resource blocks nprB = 6..14,30..49 are allocated for the user data in all subframes.

Note 7: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in sub-frames 0,3,4,6,7,8,9.

Note 8: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,3,4,6,7,8,9.

Note 9: Resource blocks n_{PRB} = 4..71 are allocated for the user data in all sub-frames

Note10: Given per component carrier per codeword.

A.3.10 Reference Measurement Channels for EPDCCH performance requirements

A.3.10.1 FDD

Table A.3.10.1-1: Reference Channel FDD

Parameter	Unit	Value								
Reference channel		R.55 FDD	R.56 FDD	R.57 FDD	R.58 FDD	R.59 FDD	R.55-1 FDD			
Number of transmitter antennas		2	2	2	2	2	2			
Channel bandwidth	MHz	10	10	10	10	10	10			
Number of OFDM symbols for PDCCH	symbols	2	2	1	1	1	2			
Aggregation level	ECCE	4	16	2	8	2	4			
DCI Format		2A	2A	2C	2C	2D	2C			

A.3.10.2 TDD

Table A.3.10.2-1: Reference Channel TDD

Parameter	Unit	Value								
Reference channel		R.55 TDD	R.56 TDD	R.57 TDD	R.58 TDD	R.59 TDD	R.55 TDD			
Number of transmitter antennas		2	2	2	2	2	2			
Channel bandwidth	MHz	10	10	10	10	10	10			
Number of OFDM symbols for PDCCH	symbols	2	2	1	1	1	2			
Aggregation level	CCE	4	16	2	8	2	4			
DCI Format		2A	2A	2C	2C	2D	2C			

A.3.11 Reference Measurement Channels for MPDCCH performance requirements

A.3.11.1 FDD and half-duplex FDD

Table A.3.11.1-1: Reference Channel FDD and half-duplex FDD

Parameter	Unit	Value	Value
Reference channel		R.82 FDD	R.83 FDD
Number of transmitter antennas		2	2
Channel bandwidth	MHz	10	10
OFDM starting symbol (startSymbolLC)	symbols	2	2
Aggregation level	ECCE	16	24
DCI Format		6-1A	6-1B
Payload (without CRC)	Bits	29	18
PRB allocation		8-th ~11-th PRB	As specified in Test

A.3.11.2 TDD

Table A.3.11.2-1: Reference Channel TDD

Parameter	Unit	Value	Value		
Reference channel		R.82 TDD	R.83 TDD		
Number of transmitter antennas		2	2		
Channel bandwidth	MHz	10	10		
OFDM starting symbol (startSymbolLC)	symbols	2	2		
Aggregation level	ECCE	16	24		
DCI Format		6-1A	6-1B		
Payload (without CRC)	Bits	32	18		
PRB allocation		8-th ~11-th PRB	As specified in Test		

A.3.12 Reference measurement channels for NPDSCH performance requirements

A.3.12.1 In-band

A.3.12.1.1 Two-antenna transmission

Table A.3.12.1.1-1: NPDSCH Reference Channel with 2 TX Antennas

Parameter	Unit	Value	Value
Reference channel		R.NB.5 FDD	R.NB.5-1 FDD
Carrier Type		Anchor	Non-anchor
Channel bandwidth	KHz	200	200
Allocated subframes per Radio Frame		Note 2	Note 2
Modulation		QPSK	QPSK
I _{TBS} /I _{SF}		4/0	4/0
Target Coding Rate		1/3	1/3
Coding Rate		0.4	0.4
Information Bit Payload			
For Sub-Frames 1,2,3,6,7,8	Bits	56	56
For Sub-Frame 0,5	Bits	N/A	56
For Sub-Frame 4,9	Bits	Note 3	56
Number of Code Blocks			
For Sub-Frames 1,2,3,6,7,8		1	1
For Sub-Frame 0,5	Bits	N/A	1
For Sub-Frame 4,9	Bits	Note 4	1
Binary Channel Bits			
For Sub-Frames 1,2,3,6,7,8	Bits	200	200
For Sub-Frame 0,5	Bits	N/A	200
For Sub-Frame 4,9	Bits	Note 5	200
Max. Averaged Throughput	Bps	Note 6	Note 6
UE Category		NB1	NB1

Note 1: For in-band, the first 3 symbols are used for LTE PDCCH and the number of LTE CRS ports is 4.

Note 2: It shall depend on the specific NPDSCH scheduling.

Note 3: N/A when $n_f \mod 2 = 0$, otherwise 56.

Note 4: N/A when $n_{\rm f} \bmod 2 = 0$, otherwise 1.

Note 5: N/A when $n_f \mod 2 = 0$, otherwise 200.

Note 6: Maximum Average Throughput equals to sum of TB(i) divided by sum of T(i), where TB(i) is the TB size of NPDSCH over ith NPDSCH scheduling period, and T(i) is the total time consisting of NPDCCH transmission duration, NPDCCH to NPDSCH scheduling delay, NPDSCH transmission duration, NPDSCH to NPUSCH format 2 scheduling delay, NPUSCH format 2 transmission duration, possible delay between NPUSCH format 2 and NPDCCH for next NPDSCH scheduling and subframes used for NPSS/NSSS/NPBCH/NB-SIB1/NB-SIB2 transmission during the ith NPDSCH scheduling period.

A.3.12.2 Standalone/Guard-band

A.3.12.3.1 Single-antenna transmission

Table A.3.12.3.1-1: NPDSCH Reference Channel with 1Tx Antenna

Parameter	Unit	Value	Value
Reference channel		R.NB.6 FDD	R.NB.6-1 FDD
Carrier Type		Anchor	Non-anchor
Channel bandwidth	KHz	200	200
Allocated subframes per Radio Frame		Note 1	Note 1
Modulation		QPSK	QPSK
I _{TBS} /I _{SF}		9/3	6/3
Target Coding Rate		1/2	1/3
Coding Rate		0.5	0.33
Information Bit Payload			
For Sub-Frames 1,2,3,6,7,8	Bits	616	392
For Sub-Frame 0,5	Bits	N/A	392
For Sub-Frame 4,9	Bits	Note 2	392
Number of Code Blocks			
For Sub-Frames 1,2,3,6,7,8		1	1
For Sub-Frame 0,5	Bits	N/A	1
For Sub-Frame 4,9	Bits	Note 3	1
Binary Channel Bits			
For Sub-Frames 1,2,3,6,7,8	Bits	320	320
For Sub-Frame 0,5	Bits	N/A	320
For Sub-Frame 4,9	Bits	Note 4	320
Max. Average Throughput	Bps	Note 5	Note 5
UE Category		NB1	NB1

Note 1: It shall depend on the specific NPDSCH scheduling.

Note 2: N/A when $n_f \mod 2 = 0$, otherwise 616.

Note 3: N/A when $n_f \mod 2 = 0$, otherwise 1.

Note 4: N/A when $n_f \mod 2 = 0$, otherwise 320.

Note 5: Maximum Average Throughput equals to sum of TB(i) divided by sum of T(i), where TB(i) is the TB size of NPDSCH over ith NPDSCH scheduling period, and T(i) is the total time consisting of NPDCCH transmission duration, NPDCCH to NPDSCH scheduling delay, NPDSCH transmission duration, NPDSCH to NPUSCH format 2 scheduling delay, NPUSCH format 2 transmission duration, possible delay between NPUSCH format 2 and NPDCCH for next NPDSCH scheduling and subframes used for NPSS/NSSS/NPBCH/NB-SIB1/NB-SIB2 transmission during the ith NPDSCH scheduling period.

A.3.13 Reference measurement channels for NPDCCH performance requirements

A.3.13.1 Half-duplex FDD

Table A.3.13.1-1: NPDCCH Reference Channel for Category NB1 UE

Parameter	Unit	Value		
Reference channel		R.NB.3 FDD	R.NB.4 FDD	
Number of NRS ports		1	2	
Channel bandwidth	MHz	0.2	0.2	
Aggregation level	NCCE	2	2	
DCI Format		N1	N1	
Payload (without CRC)	Bits	23	23	

A.3.14 Reference measurement channels for NPBCH performance requirements for Cat NB1 UEs

Table A.3.14-1: NPBCH Reference Channel for Category NB1 UE

Parameter	Unit	Value		
Reference channel		R.NB.1	R.NB.2	
Number of transmitter antennas		1	2	
Channel bandwidth	KHz	200	200	
Modulation		QPSK	QPSK	
Target coding rate		50/1600	50/1600	
Payload (without CRC)	Bits	34	34	

A.3.15 Reference Measurement Channels for LAA SCell with frame structure Type-3

A.3.15.1 Multi-antenna transmission (Common Reference Symbols)

A.3.15.1.1 Four antenna ports

Table A.3.15.1.1-2: Reference Channel with four CRS ports

MHz	R.1 FS3 20 100
MHz	
	100
	10
	64QAM
	0.6
Bits	{46888,15840,24496,37888,19848}
	{46888,15840,24496,37888,19848}
	{46888,15840,24496,37888,19848}
Bits	{46888,15840,24496,37888,19848}
Bits	{46888,15840,24496,37888,19848}
	{8,3,4,7,4}
	{8,3,4,7,4}
	{8,3,4,7,4}
	{8,3,4,7,4}
	{8,3,4,7,4}
Bits	{76800,26400,43200,62400,33600}
	{76800,26400,43200,62400,33600}
	{76800,26400,43200,62400,33600}
Bits	{75936,26400,43200,61536,33600}
Bits	{75936,26400,43200,61536,33600}
	≥ 5
	Bits Bits Bits

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 4: Given per component carrier per codeword.

Note 5: For {a1,a2,a3,a4,a5}, a1, a2, a3, a4 and a5 stand for the setup when the number of OFDM sybmols is 14, 6, 9, 12, 7, respectively.

A.3.15.2 Reference Measurement Channel for UE-Specific Reference Symbols

A.3.15.2.1 Two antenna ports (CSI-RS)

The reference measurement channels in Table A.3.15.2.1-1 apply for verifying demodulation performance for UE-specific reference symbols with two cell-specific antenna ports and two CSI-RS antenna ports for LAA SCell.

Table A.3.15.2.1-1: Reference Channel with two CRS ports

	Parameter	Unit	Value		
	Reference channel		R.2 FS3		
	Channel bandwidth	MHz	20		
Allocat	ed resource blocks (Note 4)		100		
Allocated	d subframes per Radio Frame		10		
	Modulation		16QAM		
	Target Coding Rate		1/2		
Inform	nation Bit Payload (Note 4)				
F	or Sub-Frames 1,4,6,9	Bits	{22920,7480,12960,19080,10296}		
	For Sub-Frames 2, 7		{22920,7480,12960,19080,10296}		
	For Sub-Frames 3, 8		{22920,7480,12960,19080,10296}		
	For Sub-Frame 5	Bits	{19848, 6712, 11448, 16992, 9144}		
	For Sub-Frame 0	Bits	{19848, 6712, 11448, 16992, 9144}		
N	umber of Code Blocks				
	(Notes 3 and 4)				
F	or Sub-Frames 1,4,6,9		{4,2,3,4,2}		
	For Sub-Frames 2,7		{4,2,3,4,2}		
	For Sub-Frames 3, 8		{4, 2, 3, 4, 2}		
	For Sub-Frame 5		{4, 2, 2, 3, 2}		
	For Sub-Frame 0		{4, 2, 2, 3, 2}		
Bina	ary Channel Bits (Note 4)				
F	or Sub-Frames 1,4,6,9	Bits	{48000,15200,25600,38400,20000}		
	For Sub-Frames 2, 7		{47200,15200,25600,38400,20000}		
	For Sub-Frames 3, 8		{46400,15200,25600,38400,20000}		
	For Sub-Frame 5	Bits	{42240,13376,22528,33792,17600}		
For Sul	b-Frame 0 (Note 5) (Note 6)	Bits	{42240,13376,22528,33792,17600}		
	UE Category		≥ 5		
Note 1:			z, 15 MHz and 10 MHz channel BW;		
		H for 5 MHz	and 3 MHz; 4 symbols allocated to		
	PDCCH for 1.4 MHz.				
Note 2:	Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [4].				
Note 3:	· ·				
	Bits is attached to each Code	Block (other	rwise L = 0 Bit).		
Note 4:	Note 4: Given per component carrier per codeword.				
Note 5:	For TM9, 100 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9				

- Note 5: For TM9, 100 resource blocks are allocated in sub-frames 1, 2, 3, 4, 6, 7, 8, 9 and 88 resource blocks (RB0-RB43,RB56-RB99) are allocated in subframe 0 and subframe 5
- Note 6: For {a1,a2,a3,a4,a5}, a1, a2, a3, a4 and a5 stand for the setup when the number of OFDM sybmols is 14, 6, 9, 12, 7, respectively

A.4 CSI reference measurement channels

This section defines the DL signal applicable to the reporting of channel status information (Clause 9.2, 9.3 and 9.5).

In Table A.4-1 are specified the reference channels. Table A.4-13 specifies the mapping of CQI index to modulation coding scheme, which complies with the CQI definition specified in Section 7.2.3 of [6].

Table A.4-0: Void

Table A.4-1: CSI reference measurement channels

RMC Name	Duplex	CH- BW	Alloc. RB-s	UL/DL Config	Alloc. SF-s	MCS Scheme	Nr. HARQ Proc.	Max. nr HARQ Trans.	Notes
1 CRS Port									
RC.1 FDD	FDD	10	50	-		MCS.1	8	1	
RC.1A FDD	FDD	10	50			MCS.1A	8	1	
RC.1 TDD	TDD	10	50	Note 3		MCS.1	10	1	
RC.1A TDD	TDD	20	100	Note 3		MCS.1B	10	1	
RC.3 FDD	FDD	10	6	-		MCS.10	8	1	
RC.3 TDD	TDD	10	6	Note 3		MCS.10	10 or 7 (Note 9)	1	
RC.4 FDD	FDD	10	15	-		MCS.15	8	1	Note 6
RC.4 TDD	TDD	10	15	Note 3		MCS.15	10	1	Note 6
RC.5 FDD	FDD	10	3	-		MCS.17	8	1	
RC.5 TDD	TDD	10	3	Note 3		MCS.17	10	1	
RC.14 FDD	FDD	5	25	-		MCS.14	8	1	
RC.15 FDD	FDD	5	15	-		MCS.15	8	1	Note 6
RC.16 FDD	FDD/HD- FDD	10	2			MCS.20	8	1	Note 8,10
RC.16 TDD	TDD	10	2	Note 3		MCS.20	10	1	Note 8
RC.23 FDD	FDD/HD- FDD	10	3			MCS.28	8	1	Note 12, 13
RC.23 TDD	TDD	10	3			MCS.28	10	1	Note 12
RC.25 FDD	FDD/HD- FDD	10	3			MCS.28	8	1	Note 12, 14
RC.25 TDD	TDD	10	3			MCS.28	10	1	Note 12, 15
2 CRS Port	s								
RC.2 FDD	FDD	10	50	-		MCS.2	8	1	
RC.2A FDD	FDD	20	100			MCS.2A	8	1	
RC.2 TDD	TDD	10	50	Note 3		MCS.2	10 or 7 (Note 9)	1	
RC.4A FDD	FDD	20	15	-		MCS.16	8	1	Note 6
RC.6 FDD	FDD	10	15	-		MCS.16	8	1	Note 6
RC.6 TDD	TDD	10	15	Note 3		MCS.16	7	1	Note 6
4 CRS Port	s								
RC.17 FDD	FDD	10	50	-		MCS.18	8	1	
RC.17 TDD	TDD	10	50	Note 3		MCS.18	7	1	
RC.21 FDD	FDD	10	50	-		MCS.26	8	1	
RC.21 TDD	TDD	10	50	Note 3		MCS.26	7	1	
1 CRS Port	+ CSI-RS								
RC.8 FDD	FDD	10	6	-	Non CSI-RS	MCS.11	8	1	
RC.8A FDD	FDD	10	6	-	2 CSI-RS Non CSI-RS 2 CSI-RS	MCS.12 MCS.11A MCS.12A	8	1	
RC.8 TDD	TDD	10	6	Note 3	Non CSI-RS 2 CSI-RS	MCS.11	10	1	
RC.8A TDD	TDD	20	8	Note 3	Non CSI-RS	MCS.11B	10	1	

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RC.9 FDD						2 CSI-RS	MCS.12B			
RC.9 FDD						Non				
RC.9A FDD 20 100 - Non CSI-RS MCS.4A 8 1	RC.9 FDD	FDD	10	50	-			8	1	
RC.9B FDD FDD 10 50 - CSI-RS MCS.4A 8 1 CSI-RS MCS.4A R R CSI-RS MCS.4A 4 CSI-RS MCS.4A 4 CSI-RS MCS.29 4 CSI-RS MCS.31 R MCS.31 R R MCS.31 R MCS.31 R MCS.31 R MCS.31 R MCS.34 R MCS.35						MCS.4				
RC.9B FDD 10 50		FDD	20	100	-		MCS.3A	8	1	
RC.9B FDD	FDD						MCS.4A			
RC.9B FDD						CSI-RS,	MCS.3			
RC.9 TDD					Non					
RC.9 TDD TDD		FDD	10	50	-		MCS.30	8	1	
RC.9 TDD TDD						4 CSI-RS,	MCS.29			
RC.9 TDD TDD 10 50 Note 3						4 CSI-RS,	MCS 31			
RC.9 TDD										
RC.9B TDD 10 50 Note 3 Note 3 RC.7FDD FDD 10 50 Note 3 RC.7FDD FDD 10 50 Note 3 RC.11FDD FDD 10 50 Note 3 RC.11FDD FDD 10 50 Note 3 RC.11FDD FDD 10 50 Note 3 RC.18FS MCS.13 RC.18FDD FDD 10 6 Note 3 RC.18FS MCS.13 RC.19FDD FDD 10 6 Note 3 RC.18FDD FDD 10 6 Note 3 RC.18FDD RC.18FDD FDD 10 6 Note 3 RC.18FDD RC.18FDD FDD 10 6 Note 3 RC.18FDD RC.18FDD FDD 10 6 Note 3 RC.18FS MCS.21 TD TD RC.18FDD FDD TDD RC 9 TDD	TDD	10	50	Note 3		MCS.3	7	1		
RC.9B TDD 10 50 Note 3 Fank 1/2 Non CSI-RS, rank 1/2 Non CSI-RS, rank 1/2 Non CSI-RS, rank 1/2 A CSI-RS, rank	110.0 122	155			11010	2 CSI-RS	MCS.4	•	·	
RC.9B TDD 10 50 Note 3							MC6 3			
RC.9B TDD 10 50 Note 3 CSI-RS rank 31/4 4 CSI-RS rank 31/4 4 CSI-RS rank 31/4 4 CSI-RS mCS.29 rank 31/4 CSI-RS mCS.29 rank 31/4 mCS.29 rank 31/4 mCS.29 rank 31/4 mCS.29 rank 31/4 mCS.29 mCS.20 mCS.29 mCS.29 mCS.20 m						rank 1/2	WCO.5			
RC.7 FDD	RC.9B	TDD	40	50	Nata 0		MCS.30	7	4	
RC.7 FDD FDD 10 50	TDD	טטו	10	50	Note 3			1	1	
RC.7 FDD FDD 10 50 -						rank 1/2	MCS.29			
RC.7 FDD							MCS.31			
RC.7 FDD	2 CRS Port	+ CSI-RS								
RC.7 TDD TDD 10 50 Note 3 Note 3 Note 3 Note 3 Note 3 Note 3 RC.11 FDD FDD 10 50 Note 3 RC.11 FDD FDD 10 50 Note 3 RC.11 FDD FDD 10 50 Note 3 RC.18 FDD FDD 10 6 RC.18 FDD FDD 10 6 Note 3 RC.18 FDD FDD 10 10 10 10 10 10 10	RC 7 FDD	FDD	10	50	_		MCS.5	8	1	
RC.7 TDD TDD 10 50 Note 3 CSI-RS (SI-RS) (MCS.8) 10 1 RC.11 FDD FDD 10 50 - - Non (CSI-RS) (MCS.6) 8 1 RC.11 TDD TDD 10 50 Note 3 - Non (CSI-RS) (MCS.6) 10 1 RC.18 FDD FDD 10 6 - Note 3 Non (CSI-RS) (MCS.13) (MCS.13) 8 1 RC.18 FDD TDD 10 6 Note 3 Non (CSI-RS) (MCS.19) 7 1 RC.18 TDD TDD 10 6 Note 3 4 ZP-CSI- (MCS.13) (MCS.13) 7 1 RC.17 TDD TDD 10 6 Note 3 4 ZP-CSI- (MCS.21) (MCS.21) 10 1 RC.18 TDD TDD 10 6 Note 3 4 ZP-CSI- (MCS.22) (MCS.22) (MCS.23) (MCS.24) (MCS.25	NO.7 T DD	100	10	30	_		MCS.7	0	'	
RC.11 FDD	DC 7 TDD	77	10	50	Note 2		MCS.5	10	1	
RC.11 FDD FDD 10 50 - CSI-RS (MCS.6) 8 1 RC.11 TDD TDD 10 50 Note 3 Note 3 Non (CSI-RS) (MCS.5) 10 1 RC.18 FDD FDD 10 6 - Note 3 Non (CSI-RS) (MCS.13) 8 1 RC.18 FDD TDD 10 6 Note 3 Non (CSI-RS) (MCS.13) 7 1 RC.18 FDD TDD 10 6 Note 3 4 ZP-CSI- (MCS.13) 7 1 RC.17 FDD TDD 10 6 Note 3 4 ZP-CSI- (MCS.21) 10 1 RC.18 FDD TDD 10 6 Note 3 4 ZP-CSI- (MCS.22) 10 1 RC.19 FDD TDD 10 41 Note 3 4 ZP-CSI- (MCS.23) 10 1 Note 1 RC.20 FDD FDD 10 50 Note 3 2 CSI-RS, (AZP-CSI- (MCS.25) 10 1 1 RC.22 FDD FDD 10 50	RC.7 TDD	טטו	10	50	Note 3		MCS.8	10	'	
RC.11 TDD							MCS.5	_	_	
RC.11 TDD TDD 10 50 Note 3 CSI-RS (MCS.6) 10 1 RC.18 FDD FDD 10 6 - Non (CSI-RS) MCS.13 (MCS.13) 8 1 RC.18 TDD TDD 10 6 Note 3 Non (CSI-RS) MCS.19 7 1 RC.17 TDD TDD 10 6 Note 3 4 ZP-CSI- (MCS.21) 10 1 RC.18 TDD TDD 10 6 Note 3 4 ZP-CSI- (MCS.22) 10 1 RC.19 TDD TDD 10 41 Note 3 4 ZP-CSI- (MCS.23) 10 1 Note 1 RC.20 TDD TDD 10 50 Note 3 2 CSI-RS, (MCS.25) 10 1 Note 1 RC.22 FDD FDD 10 50 - Note 3 - Note 3 10 1 Note 1	RC.11 FDD	FDD	10	50	-		MCS.6	8	1	
RC.11 TDD TDD 10 50 Note 3 CSI-RS / 2 CSI-RS MCS.6 10 1 RC.18 FDD FDD 10 6 - Note 3 Note 3 RCS.13 / 4 CSI-RS / MCS.19 8 1 RC.18 TDD TDD 10 6 Note 3 Note 3 / 4 CSI-RS / MCS.19 7 1 RC.17 TDD TDD 10 6 Note 3 4 ZP-CSI- RS / MCS.21 10 1 RC.18 TDD TDD 10 6 Note 3 4 ZP-CSI- RS / MCS.22 10 1 RC.19 TDD TDD 10 41 Note 3 4 ZP-CSI- RS / MCS.23 10 1 Note 1 RC.20 TDD TDD 10 50 Note 3 2 CSI-RS / RS / A ZP-CSI- RS / MCS.25 10 1 1 RC.22 FDD FDD 10 50 - Note 3 - Note 3 / Note 3 / Note 3 - - Note 3 / Note 3 / Note 3 / Note 3 / Note 3 / Note 3 - - - Note 3 / Note 3 / Note 3 / Note 3 / Note 3 / Note 3 / Note 3 / Note 3 / Note 3						Non	MCS.5			
RC.18 FDD FDD 10 6 - Non CSI-RS MCS.13 A CSI-RS MCS.19 8 1 RC.18 TDD TDD 10 6 Note 3 Non CSI-RS MCS.13 A CSI-RS MCS.19 7 1 RC.17 TDD TDD 10 6 Note 3 4 ZP-CSI-RS MCS.21 MCS.21 10 1 RC.18 TDD TDD 10 6 Note 3 4 ZP-CSI-RS MCS.22 MCS.22 10 1 RC.19 TDD TDD 10 41 Note 3 4 ZP-CSI-RS MCS.23 MCS.23 10 1 Note 1 RC.20 TDD TDD 10 50 Note 3 2 CSI-RS, A ZP-CSI-RS MCS.25 RS 10 1 Note 1 RC.22 FDD FDD 10 50 - Note 3 Note 3 Note 3 10 1 1 Note 1	RC.11 TDD	TDD	10	50	Note 3			10	1	
RC.18 FDD FDD 10 6 - CSI-RS MCS.19 8 1 RC.18 TDD TDD 10 6 Note 3 Non CSI-RS MCS.13 7 1 RC.17 TDD TDD 10 6 Note 3 4 ZP-CSI- RS MCS.21 10 1 RC.18 TDD TDD 10 6 Note 3 4 ZP-CSI- RS MCS.22 10 1 RC.19 TDD TDD 10 41 Note 3 4 ZP-CSI- RS MCS.23 10 1 Note 1 RC.20 TDD TDD 10 50 Note 3 2 CSI-RS, 4 ZP-CSI- RS MCS.24 10 1 RC.22 FDD FDD 10 50 - Non CSI-RS MCS.5 8 1						Non				
RC.18 TDD TDD 10 6 Note 3 Non CSI-RS (SI-RS) (MCS.13) (A CSI-RS) MCS.13 (A CSI-RS) (MCS.19) 7 1 RC.17 TDD TDD 10 6 Note 3 4 ZP-CSI- RS (MCS.21) (MCS.21) (MCS.22) (MCS.22) (MCS.22) (MCS.22) (MCS.22) (MCS.23) (MCS.23) (MCS.23) (MCS.23) (MCS.23) (MCS.23) (MCS.23) (MCS.23) (MCS.23) (MCS.23) (MCS.24) (MCS.24) (MCS.24) (MCS.24) (MCS.24) (MCS.25) (M	RC.18 FDD	FDD	10	6	-			8	1	
RC.18 TDD TDD 10 6 Note 3 CSI-RS 7 1 RC.17 TDD TDD 10 6 Note 3 4 ZP-CSI- RS MCS.21 10 1 RC.18 TDD TDD 10 6 Note 3 4 ZP-CSI- RS MCS.22 10 1 RC.19 TDD TDD 10 41 Note 3 4 ZP-CSI- RS MCS.23 10 1 Note 1 RC.20 TDD TDD 10 50 Note 3 2 CSI-RS, AS 10 1 1 Note 1 RC.22 FDD FDD 10 50 - Note 3 Note 3 Note 3 1 Note 3 1						Non				
RC.17 TDD TDD 10 6 Note 3 4 ZP-CSI-RS MCS.21 10 1 RC.18 TDD TDD 10 6 Note 3 4 ZP-CSI-RS MCS.22 10 1 RC.19 TDD TDD 10 41 Note 3 4 ZP-CSI-RS MCS.23 10 1 Note 1 RC.20 TDD TDD 10 50 Note 3 2 CSI-RS, 4 ZP-CSI-RS MCS.24 10 1 RC.22 FDD FDD 10 50 - Non CSI-RS MCS.5 8 1	RC.18 TDD	TDD	10	6	Note 3			7	1	
RC.17 TDD TDD 10 6 Note 3 RS MCS.21 10 1 RC.18 TDD TDD 10 6 Note 3 4 ZP-CSI-RS MCS.22 10 1 RC.19 TDD TDD 10 41 Note 3 4 ZP-CSI-RS MCS.23 10 1 Note 1 RC.20 TDD TDD 10 50 Note 3 2 CSI-RS, A ZP-CSI-RS MCS.24 10 1 RC.22 FDD FDD 10 50 - Non CSI-RS MCS.5 8 1	20 12 722									
RC.19 TDD TDD 10 6 Note 3 RS MCS.22 10 1 RC.19 TDD TDD 10 41 Note 3 RS MCS.23 10 1 Note 1 RC.20 TDD TDD 10 50 Note 3 RS MCS.23 10 1 Note 1 RC.20 TDD TDD 10 50 Note 3 2 CSI-RS, 4 ZP-CSI-RS MCS.25 RS RC.22 FDD FDD 10 50 - CSI-RS MCS.5 8 1	RC.17 TDD	rdd	10	6	Note 3	RS		10	1	1
RC.20 TDD TDD 10 41 Note3 RS MCS.23 10 1 Note 1 RC.20 TDD	RC.18 TDD	TDD	10	6	Note 3	RS	MCS.22	10	1	
RC.20 TDD TDD 10 50 Note3 Note3 Note3 RS Non CS.24 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	RC.19 TDD	TDD	10	41	Note3		MCS.23	10	1	Note 11
RC.20 TDD TDD 10 50 Note3 2 CSI-RS, 4 ZP-CSI- MCS.25 RS 10 1 RC.22 FDD FDD 10 50 - CSI-RS MCS.5 8 1						Non	MCS.24			
RS Non MCS.5 8 1	RC.20 TDD	TDD	10	50	Note3	2 CSI-RS,		10	1	
RC.22 FDD FDD 10 50 - Non CSI-RS MCS.5 8 1							MCS.25			
	BC 33 EDD	EDD	10	50	_	Non	MCS.5	Ω	1	
	1.0.22 1.00	טטיו	10	30	_	4 CSI-RS	MCS.27	U	'	
RC.22 TDD	RC.22 TDD	TDD	10	50	Note 3		MCS.5	10	1	
1 CRS Port + CSI-RS + CSI-IM							MCS.27			

DC 42 EDD	FDD	10	50		Non CSI- RS/IM	MCS.3	8	1	
RC.13 FDD	רטט	10	50	-	CSI- RS/IM	N/A	0	ļ	
RC.13 TDD	TDD	10	50	Note 3	Non CSI- RS/IM	MCS.3	10	1	
NO.13 1DD	100	10	30	Note 3	CSI- RS/IM	N/A	10	'	
2 CRS Port	+ CSI-RS	+ CSI-IM							
					Non CSI-RS	MCS.5			
RC.10 FDD	FDD	10	50	-	4 CSI-RS, 1 CSI process	MCS.8	8	1	
					Non CSI-RS	MCS.5			
RC.10 TDD	TDD	10	50	Note 3	8 CSI-RS, 1 CSI process	MCS.9	10	1	
BC 12 EDD	FDD	10	6		Non CSI- RS/IM	MCS.13	8	1	
RC.12 FDD	FDD	10	0	-	CSI- RS/IM	N/A	0	'	
RC.12 TDD	TDD	10	6	Note 3	Non CSI- RS/IM	MCS.13	10	1	
			0	Note 3	CSI- RS/IM	N/A	10		

- Note 1: 3 symbols allocated to PDCCH.
- Note 2: For FDD only subframes 1, 2, 3, 4, 6, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead.
- Note 3: TDD UL-DL configuration as specified in the individual tests.
- Note 4: For TDD when UL-DL configuration 1 is used only subframes 4 and 9 are allocated to avoid PBCH and synchronizaiton signal overhead.
- Note 5: For TDD when UL-DL configuration 2 is used only subframes 3, 4, 8, and 9 are allocated to avoid PBCH and synchronization signal overhead.
- Note 6: Centered within the Transmission Bandwidth Configuration (Figure 5.6-1).
- Note 7: Only subframes 2, 3, 4, 7, 8 and 9 are allocated to avoid PBCH and synchronization signal overhead.
- Note 8: Allocate PDSCH on 5th and 6th PRBs within a subband.
- Note 9: The number of HARQ processes is 10 for TDD UL/DL configuration 2 and 7 for TDD UL/DL configuration 1.
- Note 10: The downlink subframes are scheduled at the 1st, 2nd, 8th, 9th, 16th, 17th, 18th, 24th, 26th, 32nd, 33rd, 34th subframes every 40ms. Information bit payload is available if downlink subframe is scheduled.(starting from 0th subframe)
- Note 11: 41 resource blocks (RB0-RB20 and RB30-RB49) are allocated in subframe 0 and 5 in RC.19 TDD.
- Note 12: Allocate PDSCH on 3th, 4th and 5th PRBs within a narrowband. Allocate MPDCCH on the 0th and 1st PRBs within a narrowband.
- Note 13: The PDSCH subframes are scheduled at the 0th and 1st subframes every 10ms. Information bit payload is available if downlink subframe is scheduled (starting from 0th subframe). MPDCCH subframes are scheduled at the 8th and 9th subframes every 10ms.
- Note 14: The downlink subframes are scheduled at the 0th to 4th subframes every 20ms. Information bit payload is scheduled at the 4th subframe (starting from 0th subframe). MPDCCH and Information bit payload are not scheduled in the radio frames where systemInformation1-BR is scheduled, and $N_{
 m PDSCH}^{
 m SIB1-BR}=4$ with the set of frames and subframes for SIB1-BR defined in TS 36.211 [16] Table 6.4.1-2.
- Note 15: Information bit payload is scheduled at the 8th subframe every 20ms (starting from 0th subframe).

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Table	Δ Δ	1_1 o	· V	hio
Iabi	- ^	T- I C		ulu

Table A.4-1b: Void

Table A.4-1c: Void

Table A.4-1d: Void

Table A.4-1e: Void

Table A.4-2: Void

Table A.4-2a: Void

Table A.4-2b: Void

Table A.4-2c: Void

Table A.4-2d: Void

Table A.4-2e: Void

Table A.4-3: Void

Table A.4-3a: Void

Table A.4-3b: Void

Table A.4-3c: Void

Table A.4-3d: Void

Table A.4-3e: Void

Table A.4-3f: Void

Table A.4-3g: Void

Table A.4-3h: Void

Table A.4-3i: Void

Table A.4-3j: Void

Table A.4-3k: Void

Table A.4-3I: Void

Table A.4-3m: Void

Table A.4-4: Void

Table A.4-4a: Void

Table A.4-4b: Void

Table A.4-5: Void

Table A.4-5a: Void

Table A.4-5b: Void

Table A.4-6: Void

Table A.4-6a: Void

Table A.4-6b: Void

Table A.4-6c: Void

Table A.4-6d: Void

Table A.4-6e: Void

Table A.4-6f: Void

Table A.4-7: Void

Table A.4-8: Void

Table A.4-9: Void

Table A.4-10: Void

Table A.4-11: Void

Table A.4-12: Void

Table A.4-13: Mapping of CQI Index to Modulation coding scheme (MCS)

CQI	Index		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Target C	oding R	Rate	00R	0.0762	0.1172	0.1885	0.3008	0.4385	0.5879	0.3691	0.4785	0.6016	0.4551	0.5537	0.6504	0.7539	0.8525	0.9258	Notes
Mod	ulation		OOR			QP	SK	i i			16QAM			'	64C)AM			
MCS Scheme	PRB	Available RE-s									Imcs								
MCS.1	50	6300	DTX	0	0	2	4	6	8	11	13	16	18	21	23	25	27	27	
MCS.2	50	6000	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS.2A	100	12000	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS.3	50	5700	DTX	0	0	2	4	6	8	10	13	15	17	19	21	23	25	26	
MCS.3A	100	11400	DTX	0	0	2	4	6	8	11	13	15	17	19	21	23	25	26	
MCS.4	50	5600	DTX	0	0	2	4	6	7	10	12	14	17	19	21	23	25	26	
MCS.4A	100	11200	DTX	0	0	2	4	6	7	10	12	14	17	19	21	23	25	26	
MCS.5	50	5400	DTX	0	0	2	3	5	7	10	12	14	17	19	21	23	24	25	
MCS.6	50	5300	DTX	0	0	1	3	5	7	10	12	14	17	19	21	22	24	25	
MCS.7	50	5200	DTX	0	0	1	3	5	7	10	12	14	17	18	20	22	24	25	
MCS.8	50	5000	DTX	0	0	1	3	5	7	10	12	13	17	18	20	22	23	24	
MCS.9	50	4800	DTX	0	0	1	3	5	7	10	12	13	17	18	20	22	23	24	
MCS.10	6	756	DTX	0	0	2	4	6	8	11	13	16	19	21	23	25	27	27	
MCS.11	6	684	DTX	0	0	2	4	6	8	11	13	14	17	20	21	23	25	27	
MCS.12	6	672	DTX	0	0	1	4	6	8	10	12	14	17	19	21	23	25	26	
MCS.13	6	648	DTX	0	0	1	3	5	7	10	12	14	17	19	21	22	24	25	
MCS.14	25	3150	DTX	0	0	2	4	6	8	11	13	16	18	21	23	25	27	27	
MCS.15	15	1890	DTX	0	0	2	4	6	8	11	13	16	18	21	23	25	27	27	
MCS.16	15	1800	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS.17	3	378	DTX	0	1	2	5	7	9	12	13	16	19	21	23	25	27	27	
MCS.18	50	5800	DTX	0	0	2	4	6	8	11	13	15	17	20	22	23	26	27	

MCS.	.19	6	624	DTX	0	0	1	3	5	7	10	12	14	17	18	20	22	24	25	
MCS	.20	2	252	DTX	0	0	2	4	6	8	11	13	16	19	21	23	23	23	23	
MCS	.21	6	696	DTX	0	0	2	4	6	8	11	13	15	18	20	21	24	25	27	
MCS.	.22	6	624	DTX	0	0	1	3	5	7	10	12	14	15	19	20	22	24	24	
MCS.	.23	41	4264	DTX	0	0	1	3	5	7	10	12	14	15	18	20	22	24	24	
MCS.	.24	50	5400	DTX	0	0	2	3	5	7	10	12	14	15	19	21	23	24	25	
MCS	.25	50	5100	DTX	0	0	1	3	5	7	8	12	13	15	18	20	22	23	24	
MCS.	.26	50	5800	DTX	0	0	2	4	6	8	11	13	15	18	20	22	24	26	27	
MCS.27	CW0	50	4600	DTX	0	0	1	3	5	6	10	11	13	17	18	19	21	23	23	
IVICS.21	CW1	50	4600	DTX	0	0	1	3	5	6	10	11	13	17	18	19	21	22	23	
MCS	29	50	5500	DTX	0	0	2	3	5	7	10	12	14	15	19	21	23	24	25	
MCS	.30	50	10200	DTX	0	0	1	3	5	7	8	12	14	15	18	20	22	23	24	
MCS	.31	50	9800	DTX	0	0	1	3	5	7	8	11	13	14	18	20	21	23	23	

Note 1: Mapping between Imcs and TBS according to Tables 7.1.7.1-1 and 7.1.7.2.1-1 in TS 36.213 [6]. Note 2: 3 symbols allocated to PDCCH.

Note 3: Sub-frame#0 and #5 are not used for the corresponding requirement except for [MCS.23]. The next subframe (i.e. sub-frame#1 or #6) shall be used for potential retransmissions.

Table A.4-14: Mapping of CQI Index to Modulation coding scheme (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

С	QI Inde	x	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Target Sp	Efficiency	OOR	0.1523	0.3770	0.8770	1.4766	1.9141	2.4063	2.7305	3.3223	3.9023	4.5234	5.1152	5.5547		6.9141	7.4063	Notes	
MCS Scheme	PRB	Available RE-s		Imcs															
MCS.1A	50	6300	DTX	0	1	3	5	7	10	11	14	16	18	20	22	24	26	26	
MCS.1B	100	12600	DTX	0	1	3	5	7	10	11	14	15	18	20	22	24	26	26	

Note 1: Mapping between Imcs and CQI Index according to Tables 7.1.7.1-1A, 7.1.7.2.1-1 and 7.2.3-2 in TS 36.213 [6].

Note 2: 3 symbols allocated to PDCCH.

Note 3: Sub-frame#0 and #5 are not used for the corresponding requirement. The next subframe (i.e. sub-frame#1 or #6) shall be used for potential retransmissions.

Table A.4-15: Mapping of CQI Index to Modulation coding scheme (Modulation and TBS index Table 2 and 4-bit CQI Table 2 are used)

С	QI Inde	x	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Target Spectral Efficiency			OOR	0.1523	0.3770	0.8770	1.4766	1.9141	2.4063	2.7305	3.3223	3.9023	4.5234	5.1152	5.5547	6.2266	6.9141	7.4063	Notes
MCS Scheme	PRB	Available RE-s		1	Imcs														
MCS.11A	6	684	DTX	0	1	3	5	7	8	10	13	14	16	18	20	22	24	25	
MCS.12A	6	672	DTX	0	1	3	5	6	8	10	12	14	16	18	20	22	24	25	
MCS.11B	8	912	DTX	0	1	3	5	7	9	10	13	14	16	18	19	22	24	26	
MCS.12B	8	896	DTX	0	1	3	5	6	8	10	12	14	16	18	19	22	24	25	

Note 1: Mapping between Imcs and CQI Index according to Tables 7.1.7.1-1A, 7.1.7.2.1-1 and 7.2.3-2 in TS 36.213 [6].

Note 2: 3 symbols allocated to PDCCH.

Note 3: Sub-frame#0 and #5 are not used for the corresponding requirement. The next subframe (i.e. sub-frame#1 or #6) shall be used for potential retransmissions.

Table A.4-16: Mapping of CQI Index to Modulation coding scheme (Modulation and TBS indx Table 3)

(CQI Inde	x	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Target Cod	ding Rat	te	OOR	0.0391	0.0762	0.1172	0.1885		0.4385	0.5879		0.4785	0.6015	Reserved	Reserved	Reserved	Reserved	Reserved	Notes
Modulation OOR QPSK 16QAM																			
MCS Scheme	S PRB Available Imcs																		
MCS.28	3	378	DTX	X 0 0 0 2 4 6 8 11 13 15 N/A N/A N/A N/A N/A															
Note 1: Mapping between Imcs and TBS according to Tables 7.1.7.1-1 and 7.1.7.2.1-1 in TS 36.213 [6]. Note 2: startSymbolBR = 3																			

A.5 OFDMA Channel Noise Generator (OCNG)

A.5.1 OCNG Patterns for FDD

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test) and/or allocations used for MBSFN. The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG_RA and OCNG_RB which together with a relative power level (γ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

$$\gamma_i = PDSCH_i _RA / OCNG _RA = PDSCH_i _RB / OCNG _RB$$

where γ_i denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG_RA, OCNG_RB, and the set of relative power levels γ are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a constant transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH_RA/RB and PHICH_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

For the performance requirements of UE with the CA capability, the OCNG patterns apply for each CC.

A.5.1.1 OCNG FDD pattern 1: One sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

Table A.5.1.1-1: OP.1 FDD: One sided dynamic OCNG FDD Pattern Relative power level γ_{PRB} [dB]

	Relative power level $\gamma_{\it PRB}$ [d	B]	
	Subframe		
0	5	1 – 4, 6 – 9	PDSCH
	Allocation		Data
First unallocated PRB	First unallocated PRB	First unallocated PRB	
Last unallocated PRB	Last unallocated PRB	– Last unallocated PRB	
Last arianocated i ND	Last analiocated I ND	Last analiocated 1 ND	
0	0	0	Note 1

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.1.2 OCNG FDD pattern 2: Two sided dynamic OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB $N_{RR} - 1$.

Table A.5.1.2-1: OP.2 FDD: Two sided dynamic OCNG FDD Pattern

R	Relative power level γ_{PRB} [dB]										
	Subframe										
0	0 5 1-4,6-9										
	PDSCH Data										
0 – (First allocated PRB-1)	0 – (First allocated PRB-1)	0 – (First allocated PRB-1)	i boon bata								
and	and	and									
(Last allocated PRB+1) -	(Last allocated PRB+1) –	(Last allocated PRB+1) –									
$(N_{RB}-1)$	$(N_{RB}-1)$	$(N_{RB}-1)$									
0	0	0	Note 1								

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.1.3 OCNG FDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

Table A.5.1.3-1: OP.3 FDD: OCNG FDD Pattern 3

A.II.	Re	lative power l	evel $\gamma_{{\scriptscriptstyle PRB}}$ [d	IB]		
Allocation		Subfi	rame		PDSCH Data	PMCH Data
$n_{\it PRB}$	0	5	4, 9	1 – 3, 6 – 8	Data	Data
1 – 49	0	0 (Allocation: all empty PRB-s)	0	N/A	Note 1	N/A
0 – 49	N/A	N/A	N/A	0	N/A	Note 2

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH subframes shall contain cell-specific Reference Signals only in the first symbol of the first time slot. The parameter γ_{PRB} is used to scale the power of PMCH.
- Note 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- N/A: Not Applicable

A.5.1.4 OCNG FDD pattern 4: One sided dynamic OCNG FDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

Table A.5.1.4-1: OP.4 FDD: One sided dynamic OCNG FDD Pattern for MBMS transmission

		Re	lative power l	evel $\gamma_{\it PRB}$ [dB]								
Alloca			Subfi	ame	PDSCH Data	PMCH Data						
n_{PR}	B	0, 4, 9	5	1 – 3, 6 – 8	Data	Data						
First unall PRE – Last unall PRE	B located	0	0 (Allocation: all empty PRB-s)	N/A	Note 1	N/A						
First unall PRE – Last unall PRE	B	N/A	N/A	N/A	N/A	Note 2						
Note 1:												
	uncorrel	ated pseudo ra	ındom data, wh	nich is QPSK modulated. The	e paramete	er $\gamma_{{\scriptscriptstyle PRB}}$ is						
Note 2:	Each ph		block (PRB) i	s assigned to MBSFN transn data in other PRBs over the i								

- Note 2: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH subframes shall contain cell-specific Reference Signals only in the first symbol of the first time slot. The parameter γ_{PRB} is used to scale the power of PMCH.
- Note 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

N/A: Not Applicable

A.5.1.5 OCNG FDD pattern 5: One sided dynamic 16QAM modulated OCNG FDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of DL sub-frames, when the unallocated area is continuous in the frequency domain (one sided).

Table A.5.1.5-1: OP.5 FDD: One sided dynamic 16QAM modulated OCNG FDD Pattern

Relative power level $\gamma_{\it PRB}$ [dB]					
	Subframe				
0 5 1-4,6-9					
	Allocation				
First	unallocated PRB	First unallocated PRB	First unallocated PRB		
Last unallocated PRB		Last unallocated PRB	Last unallocated PRB		
	0	0 0		Note 1	
Note 1:			arbitrary number of virtual UEs wit PDSCHs shall be uncorrelated ps		
	data, which is 16QA	AM modulated. The parameter γ	$_{PRB}$ is used to scale the power of ${ m F}$	PDSCH.	
Note 2:	If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large				
	Delay CDD). The pa	arameter $\gamma_{\scriptscriptstyle PRB}$ applies to each a	antenna port separately, so the tra	nsmit power is	

A.5.1.6 OCNG FDD pattern 6: dynamic OCNG FDD pattern when user data is in 2 non-contiguous blocks

equal between all the transmit antennas with CRS used in the test. The antenna transmission

modes are specified in section 7.1 in 3GPP TS 36.213.

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB $N_{RB}-1$.

Table A.5.1.6-1: OP.6 FDD: OCNG FDD Pattern when user data is in 2 non-contiguous blocks

	Subframe					
0	5	1 – 4, 6 – 9				
	Allocation					
0 – (First allocated PRB of	0 – (First allocated PRB of	0 – (First allocated PRB of	PDSCH Data			
first block -1)	first block -1)	first block -1)				
and	and	and				
(Last allocated PRB of first	(Last allocated PRB of first	(Last allocated PRB of first				
block +1) – (First allocated	block +1) - (First allocated	block +1) - (First allocated				
PRB of second block -1)	PRB of second block -1)	PRB of second block -1)				
0	0	0	Note 1			
	Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK					
modulated. The p	modulated. The parameter $\gamma_{\scriptscriptstyle PRB}$ is used to scale the power of PDSCH.					
Note 2: If two or more train	If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual					
users by all the tra	ansmit antennas with CRS acco	rding to transmission mode 2. T	The parameter $\gamma_{{\scriptscriptstyle PRB}}$ applies			

A.5.1.7 OCNG FDD pattern 7: dynamic OCNG FDD pattern when user data is in multiple non-contiguous blocks

used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in

multiple parts by the M allocated blocks for data transmission). The m-th allocated block starts with RPB $N_{Start,m}$ and ends with PRB $N_{End,m}-1$, where m=1,...,M. The system bandwidth starts with RPB 0 and ends with $N_{RR}-1$.

Table A.5.1.7-1: OP.7 FDD: OCNG FDD Pattern when user data is in multiple non-contiguous blocks

R			
	Subframe		
0	5	1 – 4, 6 – 9	
	Allocation		
$0 - (PRB N_{Start,1} - 1)$	0 – (PRB <i>N</i> _{Start,1} –1)	$0 - (PRB N_{Start,1} - 1)$	
			PDSCH Data
$(PRB N_{End,(m-1)}) - (PRB$	$(PRB N_{End,(m-1)}) - (PRB$	$(PRB N_{End,(m-1)}) - (PRB$	
$N_{Start,m}-1)$	$N_{Start,m}-1$)	$N_{Start,m}-1$)	
(DDD M) (DDD	(DDD M	(DDD) (DDD	
$(PRBN_{End,M}^{})$ – $(PRB$	$(PRB N_{End,M}) - (PRB$	$(PRB N_{End,M}) - (PRB$	
$N_{RB}-1$)	$N_{RB}-1$)	$N_{RB}-1$)	
0	0	0	Note 1

Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.

Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.1.8 OCNG FDD pattern 8: Dynamic OCNG FDD pattern for TM10 transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain where there are M unallocated PRB blocks labled from 1-st block to M-th block (M>1) and the m-th block starts with PRB $N_{Start,m}$ and end with PRB $N_{End,m}$, or when the unallocated area is continuous in frequency domain where M=1 (one sided). The system bandwidth starts with RPB 0 and ends with N_{RB} -1. $N_{End,M}$ should be equal to or less than N_{RB} -1.

Table A.5.1.8-1: OP.8 FDD: Dynamic OCNG FDD Pattern

		Relative power level $\gamma_{\it PRB}$ [dB]				
Subframe						
	0	5	1 – 4, 6 – 9			
		Allocation				
1-st unallocated PRB $(PRB N_{Start,1} \sim PRB N_{End,1})$ m -th unallocated PRB $(PRB N_{Start,m} \sim PRB N_{End,m})$ $$ M -th unallocated PRB $(PRB N_{Start,M} \sim PRB N_{End,M})$		1-st unallocated PRB $ (PRBN_{Start,1} \sim PRBN_{End,1}) \\ \dots \\ m\text{-th unallocated PRB} \\ (PRBN_{Start,m} \sim PRBN_{End,m}) \\ \dots \\ M\text{-th unallocated PRB} \\ (PRBN_{Start,M} \sim PRBN_{End,M}) $	$\begin{array}{c} \text{1-st unallocated PRB} \\ (\text{PRB}N_{Start,1} \sim \text{PRB}N_{End,1}) \\ \dots \\ m\text{-th unallocated PRB} \\ (\text{PRB}N_{Start,m} \sim \text{PRB}N_{End,m}) \\ \dots \\ M\text{-th unallocated PRB} \\ (\text{PRB}N_{Start,M} \sim \text{PRB}N_{End,M}) \end{array}$	PDSCH Data		
	0	0	0	Note 1,2,3		
Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is 16QAM modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.						
1000 21	Note 2: The OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode10. The the transmit power is equal between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.					

A.5.2 OCNG Patterns for TDD

Note 3:

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test). The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

The detailed test set-up for TM10 transmission i.e PMI configuration is specified to each test case.

In each test case the OCNG is expressed by parameters OCNG_RA and OCNG_RB which together with a relative power level (γ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

$$\gamma_i = PDSCH_i RA/OCNG_RA = PDSCH_i RB/OCNG_RB$$

where γ_i denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG_RA, OCNG_RB, and the set of relative power levels γ are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PCFICH/PDCCH/PHICH reference channel which specifies the control region. For any aggregation and PHICH allocation, the PDCCH and any unused PHICH groups are padded with resource element groups with a power level given respectively by PDCCH_RA/RB and PHICH_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

A.5.2.1 OCNG TDD pattern 1: One sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

Table A.5.2.1-1: OP.1 TDD: One sided dynamic OCNG TDD Pattern

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]				
	Subframe (only i	if available for DL)		
0	5	3, 4, 7, 8, 9 and 6 (as normal subframe) ^{Note 2}	1 and 6 (as special subframe) ^{Note 2}	PDSCH Data
	Allo	cation		
First unallocated PRB	First unallocated PRB	First unallocated PRB	First unallocated PRB	
_	_	_	_	
Last unallocated PRB	Last unallocated PRB	Last unallocated PRB	Last unallocated PRB	
0	0	0	0	Note 1

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.2.2 OCNG TDD pattern 2: Two sided dynamic OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB $N_{\rm RB}$ –1.

Table A.5.2.2-1: OP.2 TDD: Two sided dynamic OCNG TDD Pattern

Relative power level $~\gamma_{\it PRB}~$ [dB]					
	Subframe (only if	available for DL)			
0	5	3, 4, 6, 7, 8, 9	1,6		
		(6 as normal subframe) Note 2	(6 as special subframe) Note 2		
	Alloc	ation			
0 –	0 –	0 –	0 –		
(First allocated PRB-1)	(First allocated PRB-1)	(First allocated PRB-1)	(First allocated PRB-1)		
and	and	and	and		
(Last allocated PRB+1) -	(Last allocated PRB+1) – (Last allocated PRB+1) – (Last allocated PRB+1) – (Last allocated PRB+1) –				
$(N_{RB}-1)$ $(N_{RB}-1)$ $(N_{RB}-1)$					
0	0	0	0	Note 1	

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.2.3 OCNG TDD pattern 3: 49 RB OCNG allocation with MBSFN in 10 MHz

Table A.5.2.3-1: OP.3 TDD: OCNG TDD Pattern 3 for 5ms downlink-to-uplink switch-point periodicity

Allocation $n_{\it PRB}$		Relative power I				
		Subf	PDSCH Data	PMCH Data		
	0	5	4, 9 ^{Note 2}	1, 6		
1 – 49	0	0 (Allocation: all empty PRB-s)	N/A	0	Note 1	N/A
0 – 49	N/A	N/A	0	N/A	N/A	Note 3

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211.
- Note 3: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.
- Note 4: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- N/A Not Applicable

A.5.2.4 OCNG TDD pattern 4: One sided dynamic OCNG TDD pattern for MBMS transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided) and MBMS performance is tested.

Table A.5.2.4-1: OP.4 TDD: One sided dynamic OCNG TDD Pattern for MBMS transmission

		Relative power				
Allocation		Subframe (PDSCH Data	PMCH Data		
$n_{\it PRB}$	0 and 6 (as normal subframe)	1 (as special subframe)	5	3, 4, 7 – 9	1 DOON Data	1 mort bata

First unallocate d PRB Last unallocate d PRB	0	0 (Allocation: all empty PRB-s of DwPTS)	0 (Allocation: all empty PRB-s)	N/A	Note 1	N/A
First unallocate d PRB Last unallocate d PRB	N/A	N/A	N/A	N/A	N/A	Note2

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Each physical resource block (PRB) is assigned to MBSFN transmission. The data in each PRB shall be uncorrelated with data in other PRBs over the period of any measurement. The MBSFN data shall be QPSK modulated. PMCH symbols shall not contain cell-specific Reference Signals.
- Note 3: If two or more transmit antennas are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode 2. The transmit power shall be equally split between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- N/A Not Applicable

A.5.2.5 OCNG TDD pattern 5: One sided dynamic 16QAM modulated OCNG TDD pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the sub-frames available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is continuous in frequency domain (one sided).

Table A.5.2.5-1: OP.5 TDD: One sided dynamic 16QAM modulated OCNG TDD Pattern

		Relative power	level $\gamma_{\it PRB}$ [dB]			
	Subframe (only if available for DL)					
0		5	3, 4, 7, 8, 9 5 and 6 (as normal subframe) ^{Note 2}		PDSCH Data	
		Allo	cation			
First unal	located PRB	First unallocated PRB -	First unallocated PRB -	First unallocated PRB -		
Last unal	Last unallocated PRB Last unallocated PRB Last unallocated PRB Last unallocated PRB					
	0	0	0	0	Note 1	
Note 1:			ssigned to an arbitrary num ne OCNG PDSCHs shall be			
	which is 16Q	AM modulated. The para	meter $\gamma_{\it PRB}$ is used to scale	e the power of PDSCH.		
Note 2:	Subframes a 3GPP TS 36		ion depends on the Uplink-	Downlink configuration in	Table 4.2-2 in	
Note 3:	Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 3 (Large Delay					
	CDD). The parameter $\gamma_{\scriptscriptstyle PRB}$ applies to each antenna port separately, so the transmit power is equal					
		he transmit antennas with section 7.1 in 3GPP TS 30	n CRS used in the test. The 6.213.	e antenna transmission m	odes are	

A.5.2.6 OCNG TDD pattern 6: dynamic OCNG TDD pattern when user data is in 2 non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the subframes available for DL transmission (depending on TDD UL/DL configuration), when the unallocated area is discontinuous in frequency domain (divided in two parts by the first allocated block). The second allocated block ends with PRB $N_{RB}-1$.

Table A.5.2.6-1: OP.6 TDD: OCNG TDD Pattern when user data is in 2 non-contiguous blocks

Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]				
Subframe (only if available for DL)				
0	5	3, 4, 6, 7, 8, 9	1,6	
		(6 as normal subframe) Note 2	(6 as special subframe) Note 2	
	Alloc	ation		
0 – (First allocated PRB	0 – (First allocated PRB	0 – (First allocated PRB	0 – (First allocated PRB	
of first block -1)	of first block -1)	of first block -1)	of first block -1)	
and	and	and	and	
(Last allocated PRB of	(Last allocated PRB of	(Last allocated PRB of	(Last allocated PRB of	
first block +1) – (First	first block +1) – (First	first block +1) – (First	first block +1) - (First	
allocated PRB of second	allocated PRB of second	allocated PRB of second	allocated PRB of second	
block -1)	block -1)	block -1)	block -1)	
0	0	0	0	Note 1

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.2.7 OCNG TDD pattern 7: dynamic OCNG TDD pattern when user data is in multiple non-contiguous blocks

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data, EPDCCH or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in multiple parts by the M allocated blocks for data transmission). The m-th allocated block starts with RPB $N_{Start,m}$ and ends with PRB $N_{End,m}-1$, where m=1,...,M. The system bandwidth starts with RPB 0 and ends with $N_{RB}-1$.

Table A.5.2.7-1: OP.7 TDD: OCNG TDD Pattern when user data is in multiple non-contiguous blocks

	Relative power level $\gamma_{\scriptscriptstyle PRB}$ [dB]				
	Subframe (only it	f available for DL)		Data	
0	5	3, 4, 6, 7, 8, 9 (6 as normal subframe) Note 2	1,6 (6 as special subframe)		
	Alloc	ation			
$0-(\mathrm{PRB}N_{Start,1}-1)$	$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$	$0 - (PRB N_{Start,1} - 1)$		
$(PRB N_{End,(m-1)}) -$	$(PRB N_{End,(m-1)}) -$	$(PRB N_{End,(m-1)}) -$	$(PRB N_{End,(m-1)}) -$		
(PRB $N_{Start,m} - 1$)	(PRB $N_{Start,m} - 1$)	(PRB $N_{Start,m} - 1$)	(PRB $N_{Start,m} - 1$)		
•••					
$(PRB N_{End,M}) - (PRB$	$(PRB N_{End,M}) - (PRB$	$(PRB N_{End,M}) - (PRB$	$(PRB N_{End,M}) - (PRB$		
$N_{RB}-1)$	$N_{RB}-1$)	$N_{RB}-1$)	$N_{RB}-1$)		
0	0	0	0	Note 1	

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: Subframes available for DL transmission depends on the Uplink-Downlink configuration in Table 4.2-2 in 3GPP TS 36.211
- Note 3: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.

A.5.2.8 OCNG TDD pattern 8: Dynamic OCNG TDD pattern for TM10 transmission

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain where there are M unallocated PRB blocks labled from 1-st block to M-th block (M>1) and the m-th block starts with PRB $N_{Start,m}$ and end with PRB $N_{End,m}$, or when the unallocated area is continuous in frequency domain where M=1 (one sided). The system bandwidth starts with RPB 0 and ends with N_{RB} -1. $N_{End,M}$ should be equal to or less than N_{RB} -1.

Note 3:

Table A.5.2.8-1: OP.8 TDD: Dynamic OCNG TDD Pattern

		Relative power level $\gamma_{\it PRB}$ [dB]					
Subframe							
	0	5	1 – 4, 6 – 9				
		Allocation					
(PRB N_{Start}) m -th una (PRB N_{Start}) M -th una	allocated PRB $_{t,1} \sim \text{PRB } N_{End,1}$) allocated PRB $_{t,m} \sim \text{PRB } N_{End,m}$) allocated PRB $_{t,m} \sim \text{PRB } N_{End,m}$) $_{t,m} \sim \text{PRB } N_{End,M}$)	1-st unallocated PRB $(PRB\ N_{Start,1} \sim PRB\ N_{End,1})$ m -th unallocated PRB $(PRB\ N_{Start,m} \sim PRB\ N_{End,m})$ M -th unallocated PRB $(PRB\ N_{Start,m} \sim PRB\ N_{End,m})$ $(PRB\ N_{Start,M} \sim PRB\ N_{End,M})$	1-st unallocated PRB (PRB $N_{Start,1} \sim \text{PRB } N_{End,1}$) m -th unallocated PRB (PRB $N_{Start,m} \sim \text{PRB } N_{End,m}$) M -th unallocated PRB (PRB $N_{Start,m} \sim \text{PRB } N_{End,m}$) (PRB $N_{Start,M} \sim \text{PRB } N_{End,M}$)	PDSCH Data			
	0	0	0	Note 1,2,3			
		e blocks are assigned to an arbitrarnsmitted over the OCNG PDSCHs s					
is '	16QAM modulated. ⁻	The parameter ${\gamma}_{\scriptscriptstyle PRB}$ is used to scale	the power of PDSCH.				
Note 2: The OCNG shall be transmitted to the virtual users by all the transmit antennas according to transmission mode10. The the transmit power is equal between all the transmit antennas used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.							

A.5.3 OCNG Patterns for Narrowband IoT

The following OCNG patterns are used for modelling allocations to virtual narrowband IoT UEs (which are not under test). The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

The detailed test set-up for TM10 transmission i.e PMI configuration is specified to each test case.

In each test case the OCNG is expressed by parameters OCNG_RA and OCNG_RB which together with a relative power level (γ) specifies the NPDSCH EPRE-to-NRS EPRE ratios in OFDM symbols with and without Narrowband reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

$$\gamma_i = NPDSCH_i RA / OCNG RA = NPDSCH_i RB / OCNG RB$$

where γ_i denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG_RA, OCNG_RB, and the set of relative power levels γ are chosen such that when also taking allocations to the UE under test into account, as given by a NPDSCH or NPDCCH reference channel, a transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

A.5.3.1 Narrowband IoT OCNG pattern 1

Table A.5.3.1-1: NB.OP.1 FDD: OCNG FDD Pattern 1

		Relative power level γ [dB]	NPDCCH and			
Band	width	Subframe	corresponding NPDSCH			
		Unused subframes	Data			
200	KHz	0	Note 2			
Note 1: These subframes are assigned to an arbitrary number of virtual UEs with one NPDSCH per virtual UE with corresponding NPDCCH; the data transmitted over the OCNG NPDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ is used to scale the power of NPDSCH and NPDCCH.						
Note 2: Note 3:	in-band, betweer If two or transmit	sion depend on the heduling delay pecified in test cases. e OCNG shall be RS according to nna port separately,				
	so the tr test.	ansmit power is equal between all the transmit antennas v	with NRS used in the			

A.5.4 OCNG Patterns for frame structure type 3

The following OCNG patterns are used for modelling allocations to virtual UEs (which are not under test). The OCNG pattern for each sub frame specifies the allocations that shall be filled with OCNG, and furthermore, the relative power level of each such allocation.

In each test case the OCNG is expressed by parameters OCNG_RA and OCNG_RB which together with a relative power level (γ) specifies the PDSCH EPRE-to-RS EPRE ratios in OFDM symbols with and without reference symbols, respectively. The relative power, which is used for modelling boosting per virtual UE allocation, is expressed by:

$$\gamma_i = PDSCH_i RA/OCNG RA = PDSCH_i RB/OCNG RB,$$

where γ_i denotes the relative power level of the *i:th* virtual UE. The parameter settings of OCNG_RA, OCNG_RB, and the set of relative power levels γ are chosen such that when also taking allocations to the UE under test into account, as given by a PDSCH reference channel, a constant transmitted power spectral density that is constant on an OFDM symbol basis is targeted.

Moreover the OCNG pattern is accompanied by a PDCCH reference channel which specifies the control region. For any aggregation the PDCCH are padded with resource element groups with a power level given respectively by PDCCH_RA/RB as specified in the test case such that a total power spectral density in the control region that is constant on an OFDM symbol basis is targeted.

For the performance requirements of UE with the CA capability, the OCNG patterns apply for eachLAA Scell.

A.5.4.1 OCNG FS3 pattern 1: One sided dynamic OCNG frame structure type 3 pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is continuous in frequency domain (one sided).

Table A.5.4.1-1: OP.1 FS3: One sided dynamic OCNG frame structure type 3 Pattern

Relative power level $~\gamma_{\it PRB}~$ [dB]								
Subframe								
0 5 1-4,6-9								
	Allocation		- Data					
First unallocated PRB	First unallocated PRB	First unallocated PRB]					
 Last unallocated PRB 	– Last unallocated PRB	Last unallocated PRB						
0	Note 1							

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRB} is used to scale the power of PDSCH.
- Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- Note 3: Subframes available for DL transmission and Occupied OFDM symbols in each subframe depend on the downlink burst transmission pattern and its corresponding configuration

A.5.4.2 OCNG FS3 pattern 2: Two sided dynamic OCNG frame structure 3 pattern

This OCNG Pattern fills with OCNG all empty PRB-s (PRB-s with no allocation of data or system information) of the DL sub-frames, when the unallocated area is discontinuous in frequency domain (divided in two parts by the allocated area – two sided), starts with PRB 0 and ends with PRB $N_{\rm RR}-1$.

Table A.5.4.2-1: OP.2 FS3: Two sided dynamic OCNG frame structure type 3 Pattern

R	Relative power level $~\gamma_{PRB}~$ [dB]							
0								
	Allocation		PDSCH Data					
0 – (First allocated PRB-1)	0 – (First allocated PRB-1)	0 – (First allocated PRB-1)	1 Boott Bata					
and	and	and						
(Last allocated PRB+1) –	(Last allocated PRB+1) –	(Last allocated PRB+1) –						
$(N_{RB}-1)$								
0	Note 1							

- Note 1: These physical resource blocks are assigned to an arbitrary number of virtual UEs with one PDSCH per virtual UE; the data transmitted over the OCNG PDSCHs shall be uncorrelated pseudo random data, which is QPSK modulated. The parameter γ_{PRR} is used to scale the power of PDSCH.
- Note 2: If two or more transmit antennas with CRS are used in the test, the OCNG shall be transmitted to the virtual users by all the transmit antennas with CRS according to transmission mode 2. The parameter γ_{PRB} applies to each antenna port separately, so the transmit power is equal between all the transmit antennas with CRS used in the test. The antenna transmission modes are specified in section 7.1 in 3GPP TS 36.213.
- Note 3: Subframes available for DL transmission and Occupied OFDM symbols in each subframe depend on the downlink burst transmission pattern and its corresponding configuration.

A.6 Sidelink reference measurement channels

A.6.1 General

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation N_{RB}

- 1. Calculate the number of channel bits N_{ch} that can be transmitted during the first transmission of a given subframe.
- 2. Find A such that the resulting coding rate is as close to R as possible, that is,

$$\min |R - (A + 24 * (N_{CB} + 1)) / N_{ch}|, where N_{CB} = \begin{cases} 0, & \text{if } C = 1 \\ C, & \text{if } C > 1 \end{cases}$$

subject to

- a) A is a valid TB size according to section 7.1.7 of TS 36.213 [6] assuming an allocation of N_{RB} resource blocks.
- b) C is the number of Code Blocks calculated according to section 5.1.2 of TS 36.212 [5].
- 3. If there is more than one *A* that minimizes the equation above, then the larger value is chosen per default and the chosen code rate should not exceed 0.93.

A.6.1.1 Overview of ProSe reference measurement channels

In Table A.6.1.1-1 are listed the ProSe reference measurement channels specified in annexes A.6.2 to A.6.6 of this release of TS 36.101. This table is informative and serves only to a better overview. The reference for the concrete reference measurement channels and corresponding implementation's parameters as to be used for requirements are annexes A.6.2 to A.6.6 as appropriate.

Table A.6.1.1-1: Overview of ProSe reference measurement channels

Table	Name	BW	Mod	RB	UE Categ	Notes
Table A.6.2-1	-	5	QPSK	2	≥ 1	
Table A.6.2-1	-	10	QPSK	2	≥ 1	
Table A.6.2-1	-	15	QPSK	2	≥ 1	
Table A.6.2-1	-	20	QPSK	2	≥ 1	
Table A.6.2-2	-	5	QPSK	25	≥ 1	
Table A.6.2-2	-	10	QPSK	50	≥ 1	
Table A.6.2-3	-	5	16QAM	25	2-8	
Table A.6.2-3	-	10	16QAM	50	2-8	
Table A.6.2-4	-	5	16QAM	25	1	
Table A.6.2-4	-	10	16QAM	50	1	
Table A.6.3-1	D.1 FDD / D.1 TDD	5	QPSK	2	≥ 1	
Table A.6.3-1	D.1 FDD / D.1 TDD	10	QPSK	2	≥ 1	
Table A.6.3-1	D.1 FDD / D.1 TDD	15	QPSK	2	≥ 1	
Table A.6.3-1	D.1 FDD / D.1 TDD	20	QPSK	2	≥ 1	
Table A.6.4-1	CC.1 FDD	5	QPSK	1	-	
Table A.6.4-1	CC.2 FDD	10	QPSK	1	-	
Table A.6.4-1	CC.3 FDD	5	QPSK	1	-	
Table A.6.4-1	CC.4 FDD	10	QPSK	1	-	
Table A.6.4-1	CC.5 FDD	5	QPSK	1	-	
Table A.6.4-1	CC.6 FDD	10	QPSK	1	-	
Table A.6.5-1	CD.1 FDD	5/10	QPSK	10	-	
Table A.6.5-1	CD.2 FDD	5/10	16QAM	10	-	
Table A.6.5-1	CD.3 FDD	5	16QAM	25	-	
Table A.6.5-1	CD.4 FDD	10	16QAM	50	-	
Table A.6.5-1	CD.5 FDD	5/10	QPSK	2	-	
Table A.6.5-2	CD.6 FDD	5	16QAM	25	-	
Table A.6.5-2	CD.7 FDD	10	16QAM	50	-	
Table A.6.6-1	CP.1 FDD	5/10	QPSK	6	-	

A.6.2 Reference measurement channel for receiver characteristics

For ProSe Direct Discovery, Table A.6.2-1 is applicable for measurements on the Receiver Characteristics (clause 7) including the requirements of subclause 7.4D (Maximum input level).

For ProSe Direct Communication, Table A.6.2-2 is applicable for measurements on the Receiver Characteristics (clause 7) with the exception of subclause 7.4D (Maximum input level). Tables A.6.2-3, A.6.2-4, are applicable for subclause 7.4D (Maximum input level).

Table A.6.2-1: Fixed Reference measurement channel for ProSe Direct Discovery receiver requirements and maximum input level

Parameter	Unit	Value					
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				2	2	2	2
Subcarriers per resource block				12	12	12	12
Allocated subframes per Discovery period				1	1	1	1
DFT-OFDM Symbols per subframe (see				11	11	11	11
note)							
Modulation				QPSK	QPSK	QPSK	QPSK
Transport Block Size				232	232	232	232
Transport block CRC	Bits			24	24	24	24
Maximum number of HARQ transmissions				1	1	1	1
Binary Channel Bits (see note)	Bits			528	528	528	528
Max. Throughput averaged over 1 Discovery	kbps			0.725	0.725	0.725	0.725
period of 320ms	,						
UE Category				≥ 1	≥ 1	≥ 1	≥1

NOTE1: PSDCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

NOTE2: Throughput is 232 bits per Discovey period. The discovery period is configured as 320ms in the test.

Table A.6.2-2: Fixed Reference measurement channel for ProSe Direct Communication receiver requirements

Parameter	Unit	Value					
Channel bandwidth	MHz	1.4	3	5	10	15	20
Allocated resource blocks				25	50		
Subcarriers per resource block				12	12		
Packets per SA period				1	1		
Modulation				QPSK	QPSK		
Transport Block Size				2216	4392		
Transport block CRC	Bits			24	24		
Maximum number of HARQ transmissions				4	4		
Binary Channel Bits	Bits			7200	14400		
Max. Throughput averaged over 1 SA period	kbps			55.4	109.8		
of 40ms							
UE Category				≥ 1	≥ 1		

NOTE 1: For PSSCH transmission, the last symbol shall be punctured as per TS 36.211.

NOTE 2: Throughput (in kbps) will depend on SA period configuration

Table A.6.2-3: Fixed Reference measurement channel for ProSe Direct Communication for maximum input power for UE categories 2-8

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks				25	50				
Subcarriers per resource block				12	12				
Packets per SA period				1	1				
Modulation				16QAM	16QAM				
Transport Block Size				9912	18336				
Transport block CRC	Bits			24	24				
Maximum number of HARQ				4	4				
transmissions									
Binary Channel Bits	Bits			14400	28800				
Max. Throughput averaged over 1 SA period of 40ms	kbps			247.8	458.4				

NOTE 1: For PSSCH transmission, the last symbol shall be punctured as per TS 36.211.

NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

NOTE 3: Throughput (in kbps) will depend on SA period configuration

Table A.6.2-4: Fixed Reference measurement channel for ProSe Direct Communication for maximum input power for UE category 1

Parameter	Unit	Value							
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks				25	24				
Subcarriers per resource block				12	12				
Packets per SA period				1	1				
Modulation				16QAM	16QAM				
Transport Block Size				9912	10296				
Transport block CRC	Bits			24	24				
Maximum number of HARQ transmissions				4	4				
Binary Channel Bits	Bits			14400	13824				
Max. Throughput averaged over 1 SA period of 40ms	kbps			247.8	257.4				

NOTE 1: For PSSCH transmission, the last symbol shall be punctured as per TS 36.211.

NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

NOTE 3: Throughput (in kbps) will depend on SA period configuration

A.6.3 Reference measurement channels for PSDCH performance requirements

Table A.6.3-1: Fixed Reference measurement channel for PSDCH performance requirement

Parameter	Unit		Value						
Reference channel				D.1 FDD /	D.1 TDE)			
Channel bandwidth	MHz	1.4	3	5	10	15	20		
Allocated resource blocks				2	2	2	2		
Subcarriers per resource block				12	12	12	12		
DFT-OFDM Symbols per subframe (NOTE 1)				11	11	11	11		
Modulation				QPSK	QPSK	QPSK	QPSK		
Transport Block Size				232	232	232	232		
Transport block CRC	Bits			24	24	24	24		
Binary Channel Bits (NOTE 1)	Bits			528	528	528	528		
Max. Throughput averaged over 1 Discovery	kbps			0.725	0.725	0.725	0.725		
period of 320ms									
UE Category				≥ 1	≥ 1	≥ 1	≥ 1		

NOTE1: PSDCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

A.6.4 Reference measurement channels for PSCCH performance requirements

Table A.6.4-1: Fixed reference measurement channel for PSCCH performance requirement

	Parameter	Unit		Value							
Reference ch	annel		CC.1 FDD	CC.2 FDD	CC.3 FDD	CC.4 FDD	CC.5 FDD	CC.6 FDD			
Channel band	dwidth	MHz	5	10	5	10	5	10			
Allocated resource blocks			1	1	1	1	1	1			
Subcarriers p	er resource block		12	12	12	12	12	12			
DFT-OFDM S	Symbols per subframe		11	11	11	11	11	11			
(see Note 1)			11	11	1 1	11	' '	11			
Modulation			QPSK	QPSK	QPSK	QPSK	QPSK	QPSK			
Transport Blo	ock Size	Bits	41	43	41	43	41	43			
	Frequency hopping flag		0	0	1	1	1	1			
	RB assignment		Set as per PSSCH RB allocation specific in the test								
					1	(1,1)	0	(1,0)			
	Hopping bits		N/A	N/A	Type 2	Type 2	Type 1	Type 1			
Information					Hopping	Hopping	Hopping	Hopping			
bits	Time resource pattern (ITRP)		8 (unless specified otherwise in the test) (Note 3)								
	Modulation and coding scheme			Set as the	PSSCH MC	S specified	in the test				
	Timing advance indication			0 (unles	s specified c	therwise in t	he test)				
	Group destination ID				As set by hi	gher layers					
Transport blo	ck CRC	Bits	16	16	16	16	16	16			
Maximum nu	mber of HARQ transmissions		2	2	2	2	2	2			
Binary Chann	nel Bits (see Note 1,2)	Bits	264	264	264	264	264	264			
Max. Through period (bits/s	nput averaged over one sc- c-period)		41	43	41	43	41	43			

NOTE 1: PSCCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

A.6.5 Reference measurement channels for PSSCH performance requirements

Table A.6.5-1: Fixed reference measurement channel for PSSCH performance requirement

Parameter	Unit			Value		
Reference channel		CD.1 FDD	CD.2 FDD	CD.3 FDD	CD.4 FDD	CD.5 FDD
Channel bandwidth	MHz	5 / 10	5 / 10	5	10	5 / 10
Allocated resource blocks		10	10	25	50	2
Subcarriers per resource block		12	12	12	12	12
DFT-OFDM Symbols per subframe (see Note 1)		11	11	11	11	11
Modulation		QPSK	16QAM	16QAM	16QAM	QPSK
Transport Block Size		872	2536	6456	12960	328
Transport block CRC	Bits	24	24	24	24	24
Maximum number of HARQ transmissions		4	4	4	4	4
Binary Channel Bits (see Note 1,2)	Bits	2640	5280	13200	26400	528
Max. Throughput averaged over one sc-period (bits/sc-period)		872	2536	6456	12960	328

NOTE 1: PSSCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

NOTE 2: Binary channel bits per HARQ transmission.

NOTE 3: For $N_{TRP} = 8$ (FDD) and trpt-Subset = 010, $I_{TRP} = 8$ corresponds to a time repetition pattern of (1,1,0,0,0,0,0,0) as per TS 36.213.

NOTE 2: Binary channel bits per HARQ transmission.

NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Table A.6.5-2: Fixed reference measurement channel for PSSCH for maximum Sidelink processes test

Parameter	Unit	Value	
Reference channel		CD.6 FDD	CD.7 FDD
Channel bandwidth	MHz	5	10
Allocated resource blocks		25	50
Subcarriers per resource block		12	12
DFT-OFDM Symbols per subframe (see Note 1)		11	11
Modulation		16QAM	16QAM
Transport Block Size		15840	25456
Transport block CRC	Bits	24	24
Maximum number of HARQ transmissions		4	4
Binary Channel Bits (see Note 1,2)	Bits	13200	26400
Max. Throughput averaged over one sc-period (bits/sc-period)		15840	25456

NOTE 1: PSSCH transmissions are rate-matched for 12 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

NOTE 2: Binary channel bits per HARQ transmission.

NOTE 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

A.6.6 Reference measurement channels for PSBCH performance requirements

Table A.6.6-1: Fixed reference measurement channel for PSBCH performance requirement

Parameter	Unit	Value
Reference channel		CP.1 FDD
Channel bandwidth	MHz	5 / 10
Allocated resource blocks		6
Subcarriers per resource block		12
DFT-OFDM Symbols per subframe		7
(see Note 1)		1
Modulation		QPSK
Transport Block Size		40
Transport block CRC	Bits	16
Maximum number of HARQ transmissions		1
Binary Channel Bits (see Note 1,2)	Bits	1008
Max. Throughput averaged over 40ms	kbps	1

NOTE 1: PSBCH transmissions are rate-matched for 8 DFT-OFDM symbols per subframe, and the last symbol shall be punctured as per TS 36.211.

NOTE 2: Binary channel bits per HARQ transmission.

A.7 Sidelink reference resource pool configurations

A.7.1 Reference resource pool configurations for ProSe Direct Discovery demodulation tests

A.7.1.1 FDD

Table A.7.1.1-1: ProSe Direct Discovery configuration for E-UTRA FDD (Configuration #1-FDD)

I	nformation Element		Value
discRxPool	cp-Len		Normal
	discPeriod		rf32
	numRetx		0
	numRepetition		1
	tf-ResourceConfig	prb-Num	12
		prb-Start	0
		prb-End	23
		offsetIndicator	160
		subframeBitmap	10000000
			00000000
			00000000
			00000000
			00000000
	txParameters		not present
	rxParameters		not present
discTxPoolCommon			not present
discTxPowerInfo			not present
SL-SyncConfig			not present
discInterFreqList			not present

Table A.7.1.1-2: ProSe Direct Discovery configuration for E-UTRA FDD (Configuration #2-FDD)

I	nformation Element		Value
discRxPool(0)	cp-Len		Normal
	discPeriod		rf32
	numRetx		0
	numRepetition		1
	tf-ResourceConfig	prb-Num	12
		prb-Start	0
		prb-End	23
		offsetIndicator	150
		subframeBitmap	10000000
			00000000
			00000000
			00000000
			00000000
	txParameters		not present
	rxParameters		not present
discRxPool(1)	cp-Len		Normal
	discPeriod		rf32
	numRetx		0
	numRepetition		1
	tf-ResourceConfig	prb-Num	12
		prb-Start	0
		prb-End	23
		offsetIndicator	170
		subframeBitmap	10000000
			00000000
			00000000
			00000000
			00000000
	txParameters		not present
	rxParameters	tdd-Config	not present
		syncConfigIndex	0
discTxPoolCommon			not present
discTxPowerInfo			not present
SL-SyncConfig(0)	syncCP-Len		Normal
	syncOffsetIndicator		0 (160 mod
			40)
	slssid		30
	txParameters		not present
	rxParamsNCell	physCellId	1
		discSyncWindow	w1
discInterFreqList			not present

Table A.7.1.1-3: ProSe Direct Discovery configuration for E-UTRA FDD (Configuration #3-FDD)

lı	nformation Element		Value
discRxPool(iPool), iPool = 0NPool-1	cp-Len		Normal
	discPeriod		rf32
	numRetx		3
	numRepetition		=2 if NPool > 10,
			=1 otherwise
	tf-ResourceConfig	prb-Num	5MHz: min{24, 2N-24*iPool} / 2
			10MHz: 25
			15MHz: min{74, 2N-74*iPool} / 2
			20MHz: 50
		prb-Start	0
		prb-End	5 MHz: min{24, 2N-24*iPool} - 1
			10 MHz: 49
			15 MHz: min{74, 2N-74*iPool} - 1
			20 MHz: 99
		offsetIndicator	160
		subframeBitmap	a(0), a(1),, a(39), s.t.
			a(i * NPool + iPool) = 1, i = 0,,K;
			a(k) = 0 otherwise
			where
			K = 1 is NPool > 10 , $K = 3$ otherwise
	txParameters		not present
	rxParameters		not present
discTxPoolCommon			not present
discTxPowerInfo			not present
SL-SyncConfig			not present
discInterFreqList			not present

NOTE 1: The resource pool configuration description is parameterized using channel BW, number of configured resource pools (NPool), and maximum number of configured Sidelink UEs to be supported (N).

Table A.7.1.1-4: ProSe Direct Discovery configuration for E-UTRA FDD for out-of-network coverage operation (Configuration #4-FDD)

	lufa um ati a u	Flowers		Va	lue
	Information	Element		5MHz	10MHz
preconfigSync	syncCP-Len-r12			No	rmal
	syncOffsetIndicator1				1
	syncOffsetIndicator2				2
	syncTxParameters			2	23
	syncTxThreshOoC			(-110	0 dBm / (Hz)
	filterCoefficient			fo	0
	syncRefMinHyst			d	B0
	syncRefDiffHyst			dB0	
	syncTxPeriodic			TRUE	
preconfigDisc	discRxPoolList(0)	cp-Len			rmal
		discPeriod		r	f4
		numRetx			0
		numRepetition			1
		tf-ResourceConfig	prb-Num	12	25
			prb-Start	0	0
			prb-End	23	49
			offsetIndicator		0
			subframeBitmap	00000000 10000000 00000000 00000000	
		txParameters		not p	resent

A.7.1.2 TDD

Table A.7.1.2-1: ProSe Direct Discovery configuration for E-UTRA TDD Config 0 (Configuration #1-TDD)

l	Information Element				
discRxPool	cp-Len		Normal		
	discPeriod		rf32		
	numRetx		0		
	numRepetition		1		
	tf-ResourceConfig	prb-Num	12		
		prb-Start	0		
		prb-End	23		
		offsetIndicator	163		
		subframeBitmap	10000000		
			00000000		
			00000000		
			00000000		
			00000000		
			00		
	txParameters		not present		
	rxParameters		not present		
discTxPoolCommon			not present		
discTxPowerInfo			not present		
SL-SyncConfig			not present		
discInterFreqList			not present		

Table A.7.1.2-2: ProSe Direct Discovery configuration for E-UTRA TDD (Configuration #2-TDD)

lı	nformation Element		Value
discRxPool(iPool), iPool = 0NPool-1	cp-Len		Normal
	discPeriod		rf32
	numRetx		3
	numRepetition		=2 if NPool > 10,
			=1 otherwise
	tf-ResourceConfig	prb-Num	5MHz: min{24, 2N-24*iPool} / 2
			10MHz: 25
			15MHz: min{74, 2N-74*iPool} / 2
			20MHz: 50
		prb-Start	0
		prb-End	5 MHz: min{24, 2N-24*iPool} - 1
			10 MHz: 49
			15 MHz: min{74, 2N-74*iPool} - 1
			20 MHz: 99
		offsetIndicator	163
		subframeBitmap	a(0), a(1),, a(39), s.t.
			a(i * NPool + iPool) = 1, i = 0,,K;
			a(k) = 0 otherwise
			where
			K = 1 is NPool > 10 , $K = 3$ otherwise
	txParameters		not present
	rxParameters		not present
discTxPoolCommon			not present
discTxPowerInfo			not present
SL-SyncConfig			not present
discInterFreqList			not present

NOTE 1: The resource pool configuration description is parameterized using channel BWs, number of configured resource pools (NPool), and maximum number of configured Sidelink UE to be supported (N).

A.7.2 Reference resource pool configurations for ProSe Direct Communication demodulation tests

A.7.2.1 FDD

Table A.7.2.1-1: ProSe Direct Communication pre-configuration for E-UTRAN FDD for out-of-network coverage operation (Configuration #1-FDD)

Info	ormation Element / (BW config	juration)		Value (5MHz)	Value (10MHz)
preconfigSync	syncCP-Len-r12			No	rmal
	syncOffsetIndicator1				1
	syncOffsetIndicator2				2
	syncTxParameters			2	23
					0
	syncTxThreshOoC			(-110	dBm /
	·			15ł	(Hz)
	filterCoefficient			fo	0
	syncRefMinHyst			d	B0
	syncRefDiffHyst			d	В0
preconfigComm	sc-CP-Len			No	rmal
	sc-Period			sf	40
	sc-TF-ResourceConfig	prb-Num		13	25
		prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
				0001	1000
		subframeBitmap		00000000	
				00000000	
					00000
					00000
	data-CP-Len				rmal
	dataHoppingConfig	hoppingParameter		5	04
		numSubbands		n	s2
		rb-Offset			0
	ue-	data-TF-	prb-Num	13	25
	SelectedResourceConfig	ResourceConfig	•	13	20
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator	0	
					00000
					1111
			subframeBitmap		1111
					00000
					00000
		trpt-Subset-r12		0	10

Table A.7.2.1-2: ProSe Direct Communication configuration for E-UTRA FDD (Configuration #2-FDD)

Int	formation Element / (BW c	onfiguration)		Value (5MHz)	Value (10MHz)
commRxPool	sc-CP-Len			No	rmal
	sc-Period			Si	f40
	sc-TF-ResourceConfig	prb-Num		13	25
		prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
		subframeBitmap		0000 0000 0000	11100 00000 00000 00000 00000
	data-CP-Len			No	rmal
	dataHoppingConfig	hoppingParameter		5	04
		numSubbands		n	s2
		rb-Offset			0
	ue- SelectedResourceConfig	data-TF- ResourceConfig	prb-Num	13	25
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator		0
			subframeBitmap	1117 1117 0000	00000 11111 11111 00000 00000
		trpt-Subset-r12			10
	rxParametersNCell	'		not p	resent
	txParameters				resent
commTxPoolNormalCommon					resent
SL-SyncConfig					resent

Table A.7.2.1-3: ProSe Direct Communication configuration for E-UTRA FDD (Configuration #3-FDD)

	formation Element / (BW c	onfiguration)		Value (5MHz)	Value (10MHz)
commRxPool(0)	sc-CP-Len				mal
	sc-Period			sf	40
	sc-TF-ResourceConfig	prb-Num		13	25
	-	prb-Start		0	0
		prb-End		24	49
		offsetIndicator		()
				0011	0000
					0000
		subframeBitmap			0000
					0000
					0000
	data-CP-Len				mal
	dataHoppingConfig	hoppingParameter)4
		numSubbands			s2
		rb-Offset)
		data-TF-		')
	ue-		prb-Num	13	25
	SelectedResourceConfig	ResourceConfig	•		
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator)
				0000	
					0000
			subframeBitmap		0000
				1111	1111
				0000	0000
		trpt-Subset-r12		0.	10
	rxParametersNCell			not present	
	txParameters				esent
commRxPool(1)	sc-CP-Len			Normal	
	sc-Period				40
	sc-TF-ResourceConfig	prb-Num		13	25
	30-11 - Resource Coring	prb-Nam prb-Start		0	0
		prb-Start prb-End		24	49
		offsetIndicator)
					0000
		1.6 57			0000
		subframeBitmap		00000000	
					0000
				0000	0000
	data-CP-Len				mal
	dataHoppingConfig	hoppingParameter)4
		numSubbands		n	s2
		rb-Offset)
	ue-	data-TF-	prb-Num	12	O.F.
	SelectedResourceConfig	ResourceConfig	ριυ-ιναιτι	13	25
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator)
					1111
					0000
			subframeBitmap		1111
			amap		0000
					0000
		trpt-Subset-r12			10
	rxParametersNCell	tdd-Config	+		esent
	in didiffetersiveeli	syncConfigIndex)
	tyParamatara	ayrıccoringirid e x	+	,	
	txParameters				esent
commTxPoolNormalCommon	0.0.4				esent
SL-SyncConfig(0)	syncCP-Len			Nor	mal
	syncOffsetIndicator			,	1
	slssid			3	0
	txParameters				esent

rxParamsNCell	physCellId	1
	discSyncWindow	w1

Table A.7.2.1-4: ProSe Direct Communication configuration for E-UTRA FDD (Configuration #4-FDD)

In	formation Element / (BW c	onfiguration)		Value (5MHz)	Value (10MHz)
commRxPool(0)	sc-CP-Len				rmal
	sc-Period			sf	80
	sc-TF-ResourceConfig	prb-Num		13	25
		prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
					0000
					00000
		subframeBitmap			00000
					00000
					00000
	data-CP-Len				rmal
	dataHoppingConfig	hoppingParameter			04
		numSubbands			s2
		rb-Offset			0
	ue- SelectedResourceConfig	data-TF- ResourceConfig	prb-Num	13	25
		_	prb-Start	0	0
			prb-End	24	49
			offsetIndicator		0
				0000	00000
					1111
			subframeBitmap		0000
			· ·	1111	1111
				0000	0000
		trpt-Subset-r12		0	01
	rxParametersNCell			not p	resent
	txParameters				resent
commRxPool(1)	sc-CP-Len				rmal
• •	sc-Period			sf	80
	sc-TF-ResourceConfig	prb-Num		13	25
	-	prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
				0000)1111
				0000	0000
		subframeBitmap		0000	0000
		·		0000	0000
				0000	0000
	data-CP-Len			No	rmal
	dataHoppingConfig	hoppingParameter		5	04
		numSubbands		n	s2
		rb-Offset			0
	ue-	data-TF-	prb-Num	13	25
	SelectedResourceConfig	ResourceConfig	•		
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator		0
					00000
					00000
			subframeBitmap		1111
					00000
		tout Order of 40			1111
	ryDarametersMCsII	trpt-Subset-r12	1		01 recept
	rxParametersNCell				resent
a a mana Tur Da a INI - mara - IO - ma	txParameters				resent
commTxPoolNormalCommon			1		resent
SL-SyncConfig				not p	resent

Table A.7.2.1-5: ProSe Direct Communication configuration for E-UTRA FDD (Configuration #5-FDD)

Int	formation Element / (BW c	onfiguration)		Value (5MHz)	Value (10MHz)
commRxPool	sc-CP-Len			No	rmal
	sc-Period			Si	f40
	sc-TF-ResourceConfig	prb-Num		13	25
		prb-Start		0	0
		prb-End		24	49
		offsetIndicator			0
		subframeBitmap		0000 0000 0000	11000 00000 00000 00000 00000
	data-CP-Len			No	rmal
	dataHoppingConfig	hoppingParameter		5	04
		numSubbands		n	s2
		rb-Offset			0
	ue- SelectedResourceConfig	data-TF- ResourceConfig	prb-Num	13	25
			prb-Start	0	0
			prb-End	24	49
			offsetIndicator		0
			subframeBitmap	111 <i>°</i> 111 <i>°</i> 111 <i>°</i>	00000 11111 11111 11111 11111
		trpt-Subset-r12			01
	rxParametersNCell			not p	resent
	txParameters				resent
commTxPoolNormalCommon					resent
SL-SyncConfig					resent

Annex B (normative): Propagation conditions

B.1 Static propagation condition

B.1.1 UE Receiver with 2Rx

For 1 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}.$$

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}.$$

For 4 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & j & j \\ 1 & 1 - j & -j \end{bmatrix}$$

For 8 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 1 & j & j & j \\ 1 & 1 & 1 & 1 - j - j - j - j \end{bmatrix}$$

B.1.2 UE Receiver with 4Rx

For 1 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}.$$

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & j \\ 1 & -j \\ 1 & j \\ 1 & -j \end{bmatrix}.$$

For 4 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & j & j \\ 1 & 1 & -j & -j \\ 1 & -1 & j & -j \\ 1 & -1 & -j & j \end{bmatrix}.$$

For 8 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 1 & j & j & j & j \\ 1 & 1 & 1 & 1 & -j & -j & -j & -j \\ 1 & 1 & -1 & -1 & j & j & -j & -j \\ 1 & 1 & -1 & -1 & -j & -j & j & j \end{bmatrix}$$

B.2 Multi-path fading propagation conditions

The multipath propagation conditions consist of several parts:

- A delay profile in the form of a "tapped delay-line", characterized by a number of taps at fixed positions on a sampling grid. The profile can be further characterized by the r.m.s. delay spread and the maximum delay spanned by the taps.
- A combination of channel model parameters that include the Delay profile and the Doppler spectrum, that is characterized by a classical spectrum shape and a maximum Doppler frequency
- A set of correlation matrices defining the correlation between the UE and eNodeB antennas in case of multi-antenna systems.
- Additional multi-path models used for CQI (Channel Quality Indication) tests

B.2.1 Delay profiles

The delay profiles are selected to be representative of low, medium and high delay spread environments. The resulting model parameters are defined in Table B.2.1-1 and the tapped delay line models are defined in Tables B.2.1-2, B.2.1-3 and B.2.1-4.

Table B.2.1-1 Delay profiles for E-UTRA channel models

Model	Number of channel taps	Delay spread (r.m.s.)	Maximum excess tap delay (span)
Extended Pedestrian A (EPA)	7	43 ns	410 ns
Extended Vehicular A model (EVA)	9	357 ns	2510 ns
Extended Typical Urban model (ETU)	9	991 ns	5000 ns

Table B.2.1-2 Extended Pedestrian A model (EPA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.0
70	-2.0
90	-3.0
110	-8.0
190	-17.2
410	-20.8

Table B.2.1-3 Extended Vehicular A model (EVA)

Excess tap delay [ns]	Relative power [dB]
0	0.0
30	-1.5
150	-1.4
310	-3.6
370	-0.6
710	-9.1
1090	-7.0
1730	-12.0
2510	-16.9

Table B.2.1-4 Extended Typical Urban model (ETU)

Excess tap delay [ns]	Relative power [dB]
0	-1.0
50	-1.0
120	-1.0
200	0.0
230	0.0
500	0.0
1600	-3.0
2300	-5.0
5000	-7.0

B.2.2 Combinations of channel model parameters

The propagation conditions used for the performance measurements in multi-path fading environment are indicated as EVA[number], EPA[number] or ETU[number] where 'number' indicates the maximum Doppler frequency (Hz).

Table B.2.2-1 Void

B.2.3 MIMO Channel Correlation Matrices

The MIMO channel correlation matrices defined in B.2.3 apply for the antenna configuration using uniform linear arrays at both eNodeB and UE.

B.2.3.1 Definition of MIMO Correlation Matrices

Table B.2.3.1-1 defines the correlation matrix for the eNodeB

Table B.2.3.1-1 eNodeB correlation matrix

	One antenna	Two antennas	Four antennas
eNode B Correlation	$R_{eNB} = 1$	$R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$	$R_{eNB} = \begin{pmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}^*} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}^*} & \alpha^{\frac{1}{9}^*} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^* & \alpha^{\frac{4}{9}^*} & \alpha^{\frac{1}{9}^*} & 1 \end{pmatrix}$

Table B.2.3.1-2 defines the correlation matrix for the UE:

Table B.2.3.1-2 UE correlation matrix

	One antenna	Two antennas	Four antennas
UE Correlation	$R_{UE} = 1$	$R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$	$R_{UE} = \begin{pmatrix} 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9} & 1 & \beta^{1/9} & \beta^{4/9} \\ \beta^{4/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^* & \beta^{4/9} & \beta^{1/9} & 1 \end{pmatrix}$

Table B.2.3.1-3 defines the channel spatial correlation matrix R_{spat} . The parameters, α and β in Table B.2.3.1-3 defines the spatial correlation between the antennas at the eNodeB and UE.

Table B.2.3.1-3: R_{spat} correlation matrices

1x2 case	$R_{spat} = R_{UE} = \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$
1x4 case	$R_{spat} = R_{UE} = \begin{pmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}^*} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}^*} & \beta^{\frac{1}{9}^*} & 1 & \beta^{\frac{1}{9}} \\ \beta^* & \beta^{\frac{4}{9}^*} & \beta^{\frac{1}{9}^*} & 1 \end{pmatrix}$
2x1 case	$R_{spat} = R_{eNB} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix}$
2x2 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \end{bmatrix} = \begin{bmatrix} 1 & \beta & \alpha & \alpha\beta \\ \beta^* & 1 & \alpha\beta^* & \alpha \\ \alpha^* & \alpha^*\beta & 1 & \beta \\ \alpha^*\beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$
2x4 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix} = \begin{bmatrix} 1 & \beta & \alpha & \alpha \beta \\ \beta^* & 1 & \alpha \beta^* & \alpha \\ \alpha^* & \alpha^* \beta & 1 & \beta \\ \alpha^* \beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$ $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9} & 1 & \beta^{1/9} & \beta^{4/9} \\ \beta^{4/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^* & \beta^{4/9} & \beta^{1/9} & 1 \end{bmatrix}$ $R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{1/9} & 1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{4/9} & \alpha^{1/9} & 1 & \alpha^{1/9} & \alpha^{4/9} \\ \alpha^{4/9} & \alpha^{1/9} & 1 & \alpha^{1/9} & \alpha^{1/9} \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$
4x2 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^* & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$
4x4 case	$R_{spat} = R_{eNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{1}{9}} \\ \alpha^* & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}} & \beta^{\frac{1}{9}} & 1 & \beta^{\frac{1}{9}} \\ \beta^* & \beta^{\frac{4}{9}} & \beta^{\frac{1}{9}} & 1 \end{bmatrix}$

For cases with more antennas at either eNodeB or UE or both, the channel spatial correlation matrix can still be expressed as the Kronecker product of R_{eNB} and R_{UE} according to $R_{spat}=R_{eNB}\otimes R_{UE}$.

B.2.3.2 MIMO Correlation Matrices at High, Medium and Low Level

The α and β for different correlation types are given in Table B.2.3.2-1.

Table B.2.3.2-1: The α and β parameters for ULA MIMO correlation matrices

Correlation Model	α	β
Low correlation	0	0
Medium	0.3	0.9
Correlation		
Medium	0.3	0.3874
Correlation A		
High Correlation	0.9	0.9

The correlation matrices for high, medium, low and medium A correlation are defined in Table B.2.3.1-2, B.2.3.2-3, B.2.3.2-4 and B.2.3.2-5 as below.

The values in Table B.2.3.2-2 have been adjusted for the 4x2 and 4x4 high correlation cases to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spatial} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 4x2 high correlation case, a=0.00010. For the 4x4 high correlation case, a=0.00012.

The same method is used to adjust the 4x4 medium correlation matrix in Table B.2.3.2-3 to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision with a = 0.00012.

Table B.2.3.2-2: MIMO correlation matrices for high correlation

1x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 \\ 0.9 & 1 \end{pmatrix}$		
2x1 case	$R_{high} = \begin{pmatrix} 1 & 0.9 \\ 0.9 & 1 \end{pmatrix}$		
2x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 & 0.9 & 0.81 \\ 0.9 & 1 & 0.81 & 0.9 \\ 0.9 & 0.81 & 1 & 0.9 \\ 0.81 & 0.9 & 0.9 & 1 \end{pmatrix}$		
4x2 case	$R_{high} = \begin{bmatrix} 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 & 0.8999 & 0.8099 \\ 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 & 0.8099 & 0.8999 \\ 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 \\ 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 \\ 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 \\ 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 \\ 0.8999 & 0.8099 & 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \end{bmatrix}$		
4x4 case	$R_{high} = \begin{bmatrix} 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.9882 & 0.9767 & 0.9430 & 0.8894 & 0.9541 & 0.9430 & 0.9105 & 0.8587 & 0.8999 & 0.8894 & 0.8587 & 0.8099 \\ 0.9882 & 1.0000 & 0.9882 & 0.9541 & 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.8894 & 0.8999 & 0.8894 & 0.8587 \\ 0.9541 & 0.9882 & 1.0000 & 0.9882 & 0.9430 & 0.9767 & 0.9882 & 0.9767 & 0.9105 & 0.9430 & 0.9541 & 0.9430 & 0.8587 & 0.8894 & 0.8999 \\ 0.9882 & 0.9767 & 0.9430 & 0.8894 & 0.9430 & 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.9541 & 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.8587 \\ 0.9882 & 0.9767 & 0.9430 & 0.8894 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.9882 & 0.9767 & 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.8587 \\ 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.9882 & 1.0000 & 0.9882 & 0.9541 & 0.9767 & 0.9430 & 0.9430 & 0.9541 & 0.9430 & 0.9105 \\ 0.9430 & 0.9767 & 0.9882 & 0.9767 & 0.9541 & 0.9882 & 1.0000 & 0.9882 & 0.9767 & 0.9482 & 0.9767 & 0.9430 & 0.9541 \\ 0.9541 & 0.9430 & 0.9767 & 0.9882 & 0.8999 & 0.9541 & 0.9882 & 1.0000 & 0.8894 & 0.9430 & 0.9767 & 0.9430 & 0.9541 \\ 0.9541 & 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.9767 & 0.9430 & 0.8894 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.9882 & 0.9767 & 0.9430 & 0.9882 \\ 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.9882 & 0.9767 & 0.9430 & 0.9882 \\ 0.9105 & 0.9430 & 0.9541 & 0.9430 & 0.9767 & 0.9882 & 0.9767 & 0.9541 & 0.9882 & 0.9767 & 0.9882 & 0.9767 \\ 0.8587 & 0.9105 & 0.9430 & 0.9541 & 0.8894 & 0.9430 & 0.9767 & 0.9882 & 0.8999 & 0.9541 & 0.9882 & 0.9767 & 0.9882 \\ 0.8999 & 0.8894 & 0.8587 & 0.8099 & 0.9541 & 0.9430 & 0.9105 & 0.9541 & 0.9882 & 0.9767 & 0.9430 & 0.8894 & 1.0000 & 0.9882 & 0.9541 \\ 0.8587 & 0.8894 & 0.8999 & 0.8894 & 0.8587 & 0.9430 & 0.9541 & 0.9430 & 0.9105 & 0.9767 & 0.9882 & 0.9767 & 0.9430 & 0.9882 & 1.0000 & 0.9882 & 0.9541 \\ 0.8587 & 0.8894 & 0.8999 & 0.8894 & 0.9105 & 0.9430 & 0.9105 & 0.9767 & 0.9882 & 0.9767 & 0.9541 & 0.9882 & 1.0000 & 0.9882 \\ 0.8099 & 0.8587 & 0.8894 & 0.8999 & 0.8587 & 0.9105 & 0.9430 & 0.9541 & 0.8894 & 0.9430 & 0.9767$		

Table B.2.3.2-3: MIMO correlation matrices for medium correlation

1x2		N/A														
case		IV/A														
2x1		N/A														
case										>						
2x2 case						R_{mediun}	_ 0		0.3 0.27							
								27 0.3		1						
			(1	.0000	0.900	00 0.	8748	0.787	3 0.:	5856	0.527	1 0.3	000	0.2700		
			(0.9000	1.000	0.00	7873	0.874	8 0	5271	0.5850	5 0.2	700	0.3000)	
			(0.8748	0.78	73 1.	0000	0.900	0 0.	8748	0.787	3 0.5	856	0.5271		
4x2		D	().7873	0.874	48 O.	9000	1.000	0 0.	7873	0.874	3 0.5	271	0.5856		
case		R_{medium} :	= (0.5856	0.52	71 0.	8748	0.787	3 1.0	0000	0.9000	0.8	748	0.7873		
			().5271	0.585	56 O.	7873	0.874	8 0.9	9000	1.0000	0.7	873	0.8748		
			(0.3000	0.270	00 0.	.5856	0.527	1 0.	8748	0.787	3 1.0	000	0.9000)	
			(0.2700	0.300	00 0.	.5271	0.585	6 0.	7873	0.874	8 0.9	0000	1.0000		
		1.0000 0.9882	0.9541	0.8999	0.8747	0.8645	0.8347	0.7872	0.5855	0.5787	0.5588	0.5270	0.3000	0.2965	0.2862	0.2700
		0.9882 1.0000	0.9882	0.9541	0.8645	0.8747	0.8645	0.8347	0.5787	0.5855	0.5787	0.5588	0.2965	0.3000	0.2965	0.2862
		0.9541 0.9882	1.0000	0.9882	0.8347	0.8645	0.8747	0.8645	0.5588	0.5787	0.5855	0.5787	0.2862	0.2965	0.3000	0.2965
		0.8999 0.9541	0.9882	2 1.0000	0.7872	0.8347	0.8645	0.8747	0.5270	0.5588	0.5787	0.5855	0.2700	0.2862	0.2965	0.3000
		0.8747 0.8645	0.8347	0.7872	1.0000	0.9882	0.9541	0.8999	0.8747	0.8645	0.8347	0.7872	0.5855	0.5787	0.5588	0.5270
		0.8645 0.8747	0.8645	0.8347	0.9882	1.0000	0.9882	0.9541	0.8645	0.8747	0.8645	0.8347	0.5787	0.5855	0.5787	0.5588
		0.8347 0.8645	0.8747	0.8645	0.9541	0.9882	1.0000	0.9882	0.8347	0.8645	0.8747	0.8645	0.5588	0.5787	0.5855	0.5787
4x4	, n	0.7872 0.8347	0.8645	0.8747	0.8999	0.9541	0.9882	1.0000	0.7872	0.8347	0.8645	0.8747	0.5270	0.5588	0.5787	0.5855
case	R_{medium} =	0.5855 0.5787	0.5588	0.5270	0.8747	0.8645	0.8347	0.7872	1.0000	0.9882	0.9541	0.8999	0.8747	0.8645	0.8347	0.7872
		0.5787 0.5855	0.5787	0.5588	0.8645	0.8747	0.8645	0.8347	0.9882	1.0000	0.9882	0.9541	0.8645	0.8747	0.8645	0.8347
		0.5588 0.5787	0.5855	0.5787	0.8347	0.8645	0.8747	0.8645	0.9541	0.9882	1.0000	0.9882	0.8347	0.8645	0.8747	0.8645
		0.5270 0.5588	0.5787	0.5855	0.7872	0.8347	0.8645	0.8747	0.8999	0.9541	0.9882	1.0000	0.7872	0.8347	0.8645	0.8747
		0.3000 0.2965	0.2862	0.2700	0.5855	0.5787	0.5588	0.5270	0.8747	0.8645	0.8347	0.7872	1.0000	0.9882	0.9541	0.8999
		0.2965 0.3000	0.2965	0.2862	0.5787	0.5855	0.5787	0.5588	0.8645	0.8747	0.8645	0.8347	0.9882	1.0000	0.9882	0.9541
		0.2862 0.2965	0.3000	0.2965	0.5588	0.5787	0.5855	0.5787	0.8347	0.8645	0.8747	0.8645	0.9541	0.9882	1.0000	0.9882
		0.2700 0.2862	0.2965	0.3000	0.5270	0.5588	0.5787	0.5855	0.7872	0.8347	0.8645	0.8747	0.8999	0.9541	0.9882	1.0000

Table B.2.3.2-4: MIMO correlation matrices for low correlation

1x2 case	$R_{low} = \mathbf{I}_2$
1x4 case	$R_{low} = \mathbf{I}_4$
2x1 case	$R_{low} = \mathbf{I}_2$
2x2 case	$R_{low} = \mathbf{I}_4$
2x4 case	$R_{low} = \mathbf{I}_8$
4x2 case	$R_{low} = \mathbf{I}_8$
4x4 case	$R_{low} = \mathbf{I}_{16}$

In Table B.2.3.2-4, \mathbf{I}_d is the $d \times d$ identity matrix.

Table B.2.3.2-5: MIMO correlation matrices for medium correlation A

	1	1.0000	0.9000	0.6561	0.3874	0.3000	0.2700	0.1968	0.1162
		0.9000	1.0000	0.9000	0.6561	0.2700	0.3000	0.2700	0.1968
		0.6561	0.9000	1.0000	0.9000	0.1968	0.2700	0.3000	0.2700
2x4	D _	0.3874	0.6561	0.9000	1.0000	0.1162	0.1968	0.2700	0.3000
case	Medium A	0.3000	0.2700	0.1968	0.1162	1.0000	0.9000	0.6561	0.3874
		0.2700	0.3000	0.2700	0.1968	0.9000	1.0000	0.9000	0.6561
		0.1968	0.2700	0.3000	0.2700	0.6561	0.9000	1.0000	0.9000
		0.1162	0.1968	0.2700	0.3000	0.3874	0.6561	0.9000	1.0000)

B.2.3A MIMO Channel Correlation Matrices using cross polarized antennas

The MIMO channel correlation matrices defined in B.2.3A apply for the antenna configuration using cross polarized (XP/X-pol) antennas at both eNodeB and UE. The cross-polarized antenna elements with +/-45 degrees polarization slant angles are deployed at eNB and cross-polarized antenna elements with +90/0 degrees polarization slant angles are deployed at UE.

For the cross-polarized antennas, the N antennas are labelled such that antennas for one polarization are listed from 1 to N/2 and antennas for the other polarization are listed from N/2+1 to N, where N is the number of transmit or receive antennas

B.2.3A.1 Definition of MIMO Correlation Matrices using cross polarized antennas

For the channel spatial correlation matrix, the following is used:

$$R_{spat} = P(R_{eNB} \otimes \Gamma \otimes R_{UE})P^{T}$$

where

- R_{UE} is the spatial correlation matrix at the UE with same polarization,
- R_{eNB} is the spatial correlation matrix at the eNB with same polarization,
- Γ is a polarization correlation matrix, and
- $(\bullet)^T$ denotes transpose.

The matrix Γ is defined as

$$\Gamma = \begin{bmatrix}
1 & 0 & -\gamma & 0 \\
0 & 1 & 0 & \gamma \\
-\gamma & 0 & 1 & 0 \\
0 & \gamma & 0 & 1
\end{bmatrix}$$

A permutation matrix P elements are defined as

$$P(a,b) = \begin{cases} 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-1)Nr + i, & i = 1, \dots, Nr, j = 1, \dots Nt/2 \\ 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-Nt/2)Nr - Nr + i, & i = 1, \dots, Nr, j = Nt/2 + 1, \dots, Nt + i, \\ 0 & \text{otherwise} \end{cases}$$

where N_t and N_r is the number of transmitter and receiver respectively. This is used to map the spatial correlation coefficients in accordance with the antenna element labelling system described in B.2.3A.

B.2.3A.2 Spatial Correlation Matrices using cross polarized antennas at eNB and UE sides

B.2.3A.2.1 Spatial Correlation Matrices at eNB side

For 2-antenna transmitter using one pair of cross-polarized antenna elements, $R_{_{eNR}} = 1$.

For 4-antenna transmitter using two pairs of cross-polarized antenna elements, $R_{eNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$.

For 8-antenna transmitter using four pairs of cross-polarized antenna elements, $R_{eNB} = \begin{pmatrix} 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} & \alpha \\ \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} & \alpha^{\frac{4}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 & \alpha^{\frac{1}{9}} \\ \alpha^{\frac{4}{9}} & \alpha^{\frac{4}{9}} & \alpha^{\frac{1}{9}} & 1 \end{pmatrix}.$

B.2.3A.2.2 Spatial Correlation Matrices at UE side

For 2-antenna receiver using one pair of cross-polarized antenna elements, $R_{UE}=1$.

For 4-antenna receiver using two pairs of cross-polarized antenna elements, $R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$.

B.2.3A.3 MIMO Correlation Matrices using cross polarized antennas

The values for parameters α , β and γ for the cross polarized antenna models are given in Table B.2.3A.3-1.

Table B.2.3A.3-1: The α and β parameters for cross-polarized MIMO correlation matrices

Correlati	ion Model	α	β	γ					
Med	dium	0.3	0.6	0.2					
Correl	ation A								
High Co	rrelation	0.9	0.9	0.3					
Note 1:	pair of cros	Value of α applies when more than one pair of cross-polarized antenna elements at eNB side.							
Note 2:		Value of β applies when more than one pair of cross-polarized antenna elements at UF side							

The correlation matrices for high spatial correlation and medium correlation A are defined in Table B.2.3A.3-2 and Table B.2.3A.3-3 as below.

The values in Table B.2.3A.3-2 have been adjusted to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spat} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 8x2 high spatial correlation case, a=0.00010.

Table B.2.3A.3-2: MIMO correlation matrices for high spatial correlation

				1.00	000	0.0000	0.90	00 (0.0000	-0.30	000 (0.0000	-0.27	700 (0.0000		
				0.0	000 1	.0000	0.00	00 (0.9000	0.00	000 (0.3000	0.00	000	0.2700		
				0.9	000 (0.0000	1.00	00 (0.0000	-0.27	00 (0.0000	-0.30	000 (0.0000		
				0.0	000 (0.9000			.0000	0.00		0.2700	0.00		0.3000		
4x2 case			$R_{high} =$			0.0000							0.90		0.0000		
				-0.5						1.000		0.0000					
						0.3000		000 (0.2700	0.00	00 1	.0000	0.00	00 (0.9000		
				-0.2	700 (0.0000	- 0.30	000	0.0000	0.90	00 0	.0000	1.00	00 (0.0000		
				0.0	000	0.2700	0.0	000	0.3000	0.00	00 0	.9000	0.00	000 1	.0000		
		1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	-0.2700	0.0000
		0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	0.0000	0.2700
		0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000
		0.0000	0.9883	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862
		0.9542			0.0000							-0.2965					
		0.0000		0.0000								0.0000				0.0000	
		0.8999	0.0000									-0.2862					
8x2 case	$R_{high} =$			0.0000								0.0000		0.0000		0.0000	
		-0.3000	0.0000	,								0.9883		0.9542		0.8999	
		0.0000 -0.2965	0.3000	0.0000					0.2700			0.0000		0.0000		0.0000	
												0.0000		0.0000		0.9342	
		-0.2862	0.0000									0.9883		1.0000		0.9883	
		0.2002										0.0000		0.0000		0.0000	
		-0.2700	0.0000						0.0000			0.9542		0.9883		1.0000	
		0.0000	0.2700	0.0000	0.2862	0.0000	0.2965	0.0000	0.3000	0.0000	0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000

Table B.2.3A.3-3: MIMO correlation matrices for medium correlation A

	(1.0000	0.6000	0.0000 0.000	0.3000	0.1800	0.0000	0.0000 -	0.2000 -	0.1200	0.0000	0.0000 -	0.0600	- 0.0360	0.0000	0.000.0
	0.6000	1.0000	0.0000 0.000	0.1800	0.3000	0.0000	0.0000 -	0.1200 -	0.2000	0.0000	0.0000 -	0.0360	- 0.0600	0.0000	0.0000
	0.0000	0.0000 1	1.0000 0.600	0.0000	0.0000	0.3000	0.1800	0.0000	0.0000	0.2000	0.1200	0.0000	0.0000	0.0600	0.0360
	0.0000	0.0000	0.6000 1.000	0.0000	0.0000	0.1800	0.3000	0.0000	0.0000	0.1200	0.2000	0.0000	0.0000	0.0360	0.0600
	0.3000	0.1800	0.0000 0.000	0 1.0000	0.6000	0.0000	0.0000 -	0.0600 -	0.0360	0.0000	0.0000 -	0.2000	- 0.1200	0.0000	0.0000
	0.1800	0.3000	0.0000 0.000	0.6000	1.0000	0.0000	0.0000 -	0.0360 -	0.0600	0.0000	0.0000 -	0.1200	- 0.2000	0.0000	0.0000
	0.0000	0.0000	0.3000 0.180	0.0000	0.0000	1.0000	0.6000	0.0000	0.0000	0.0600	0.0360	0.0000	0.0000	0.2000	0.1200
44		0.0000	0.1800 0.300	0.0000	0.0000	0.6000	1.0000	0.0000	0.0000	0.0360	0.0600	0.0000	0.0000	0.1200	0.2000
4x4	$R_{Medium A} = \begin{bmatrix} -0.2000 \end{bmatrix}$	0.1200	0.0000 0.000	0.0600	- 0.0360	0.0000	0.0000	1.0000	0.6000	0.0000	0.0000	0.3000	0.1800	0.0000	0.0000
	- 0.1200 -	0.2000	0.0000 0.000	00 - 0.0360	- 0.0600	0.0000	0.0000	0.6000	1.0000	0.0000	0.0000	0.1800	0.3000	0.0000	0.0000
	0.0000	0.0000	0.2000 0.120	0.0000	0.0000	0.0600	0.0360	0.0000	0.0000	1.0000	0.6000	0.0000	0.0000	0.3000	0.1800
	0.0000	0.0000	0.1200 0.200	0.0000	0.0000	0.0360	0.0600	0.0000	0.0000	0.6000	1.0000	0.0000	0.0000	0.1800	0.3000
	- 0.0600	- 0.0360	0.0000 0.000	00 - 0.2000	- 0.1200	0.0000	0.0000	0.3000	0.1800	0.0000	0.0000	1.0000	0.6000	0.0000	0.0000
	- 0.0360	- 0.0600	0.0000 0.000	00 - 0.1200	- 0.2000	0.0000	0.0000	0.1800	0.3000	0.0000	0.0000	0.6000	1.0000	0.0000	0.0000
	0.0000	0.0000	0.0600 0.036	0.0000	0.0000	0.2000	0.1200	0.0000	0.0000	0.3000	0.1800	0.0000	0.0000	1.0000	0.6000
	0.0000	0.0000	0.0360 0.060	0.0000	0.0000	0.1200	0.2000	0.0000	0.0000	0.1800	0.3000	0.0000	0.0000	0.6000	1.0000

B.2.3A.4 Beam steering approach

Given the channel spatial correlation matrix in B.2.3A.1, the corresponding random channel matrix \mathbf{H} can be calculated. The signal model for the k-th subframe is denoted as

$$y = HD_{\theta_{\iota}}Wx + n$$

Where

- H is the Nr xNt channel matrix per subcarrier.
- D_{θ_k} is the steering matrix,

For 8 transmission antennas,
$$D_{\theta_k} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & e^{j\theta_k} & 0 & 0 \\ 0 & 0 & e^{j2\theta_k} & 0 \\ 0 & 0 & 0 & e^{j3\theta_k} \end{bmatrix};$$

For 4 transmission antennas,
$$D_{\theta_k} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & 0 \\ 0 & e^{j3\theta_k} \end{bmatrix}$$
.

- θ_k controls the phase variation, and the phase for k-th subframe is denoted by $\theta_k = \theta_0 + \Delta\theta \cdot k$, where θ_0 is the random start value with the uniform distribution, i.e., $\theta_0 \in [0,2\pi]$, $\Delta\theta$ is the step of phase variation, which is defined in Table B.2.3A.4-1, and k is the linear increment of 1 for every subframe throughout the simulation,
- W is the precoding matrix for Nt transmission antennas,
- y is the received signal, x is the transmitted signal, and n is AWGN.

Table B.2.3A.4-1: The step of phase variation

Variation Step	Value (rad/subframe)
$\Delta heta$	1.2566×10 ⁻³

B.2.3B MIMO Channel Correlation Matrices using two-dimension cross polarized antennas at eNB and cross polarized antennas at UE

The MIMO channel correlation matrices defined in B.2.3B apply for the antenna configuration using two-dimension (2D) cross polarized antennas at eNodeB and the antenna configuration using cross polarized antennas at UE. The cross-polarized antenna elements with \pm 45 degrees polarization slant angles are deployed at eNB and cross-polarized antenna elements with \pm 90/0 degrees polarization slant angles are deployed at UE.

For 2D cross-polarized antenna array at eNodeB, the N antennas are indexed by (N_1, N_2, P) , and total number of antennas is $N = P \cdot N_1 \cdot N_2$, where

- N_1 is the number of antenna elements in first dimension (i.e. vertical direction) with same polarization,
- N_2 is the number of antenna elements in second dimension (i.e. horizontal direction) with same polarization, and
- P is the number of polarization groups.

For the 2D cross-polarized antennas at eNB, the N antennas are labelled such that antennas shall be in increasing order of the second dimension firstly, then the first dimension, and finally the polarization group. For a specific antenna

element at p-th polarization, n_1 -th row, and n_2 -th column within the 2D antenna array, the following index number is used for antenna labelling:

$$Index(p, n_1, n_2) = p \cdot N_1 \cdot N_2 + n_1 \cdot N_2 + n_2 + 1,$$
 $p = 0, 1, n_1 = 0, \dots, N_1 - 1, n_2 = 0, \dots, N_2 - 1.$

where N is the number of transmit antennas, p is the polarization group index, n_1 is the row index, and n_2 is the column index of the antenna element.

For the cross-polarized antennas at UE, the N antennas are labelled such that antennas for one polarization are listed from 1 to N/2 and antennas for the other polarization are listed from N/2+1 to N, where N is the number of receive antennas.

B.2.3B.1 Definition of MIMO Correlation Matrices using two-dimension cross polarized antennas at eNB and cross polarized antennas at UE

For the channel spatial correlation matrix, the following is used:

$$R_{spat} = P(R_{eNB} \otimes \Gamma \otimes R_{UE})P^{T}$$

where

- R_{UE} is the spatial correlation matrix at the UE with same polarization,
- R_{eNB} is the spatial correlation matrix at the eNB with same polarization,
- Γ is a polarization correlation matrix, and
- $(\bullet)^T$ denotes transpose.

The spatial correlation matrix at the eNB is further expressed as following:

$$R_{eNB} = R_{eNB Dim.1} \otimes R_{eNB Dim.2}$$

where

- $R_{eNB_Dim,1}$ is the correlation matrix of antenna elements in first dimension with same polarization, and
- $R_{PNR-Dim,2}$ is the correlation matrix of antenna elements in second dimension with same polarization.

The matrix Γ is defined as

$$\Gamma = \begin{bmatrix}
1 & 0 & -\gamma & 0 \\
0 & 1 & 0 & \gamma \\
-\gamma & 0 & 1 & 0 \\
0 & \gamma & 0 & 1
\end{bmatrix}$$

A permutation matrix P elements are defined as

$$P(a,b) = \begin{cases} 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-1)Nr + i, & i = 1, \dots, Nr, j = 1, \dots Nt/2 \\ 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-Nt/2)Nr - Nr + i, & i = 1, \dots, Nr, j = Nt/2 + 1, \dots, Nt + i, \\ 0 & \text{otherwise} \end{cases}$$

where N_r and N_r is the number of transmitter and receiver respectively. This is used to map the spatial correlation coefficients in accordance with the antenna element labelling system described in B.2.3B.

B.2.3B.2 Spatial Correlation Matrices using two-dimension cross polarized antennas at eNB and cross polarized antennas at UE

B.2.3B.2.1 Spatial Correlation Matrices at eNB side

For one direction of the 2D antenna array at the eNB side, the followings are used to construct the spatial correlation matrix:

For 1 antenna element of the same polarization in one direction, $R_{eNB-Dim,i} = 1$.

For 2 antenna elements of the same polarization in one direction, $R_{eNB_Dim,i} = \begin{pmatrix} 1 & \alpha_i \\ \alpha_i^* & 1 \end{pmatrix}$.

For 3 antenna elements of the same polarization in one direction, $R_{eNB_Dim,i} = \begin{pmatrix} 1 & \alpha_i^{1/4} & \alpha_i \\ \alpha_i^{1/4} & 1 & \alpha_i^{1/4} \\ \alpha_i^* & \alpha_i^{1/4} & 1 \end{pmatrix}$.

For 4 antenna elements of the same polarization in one direction, $R_{eNB_Dim,i} = \begin{pmatrix} 1 & \alpha_i^{1/9} & \alpha_i^{4/9} & \alpha_i \\ \alpha_i^{1/9} & 1 & \alpha_i^{1/9} & \alpha_i^{4/9} \\ \alpha_i^{4/9} & \alpha_i^{1/9} & 1 & \alpha_i^{1/9} \\ \alpha_i^* & \alpha_i^{4/9} & \alpha_i^{1/9} & 1 \end{pmatrix}.$

where the index i = 1,2 stands for first dimension and second dimension respectively.

B.2.3B.2.2 Spatial Correlation Matrices at UE side

For 2-antenna receiver using one pair of cross-polarized antenna elements, $R_{\rm UE}=1$.

For 4-antenna receiver using two pairs of cross-polarized antenna elements, $R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$.

B.2.3B.3 MIMO Correlation Matrices using two-dimension cross polarized antennas at eNB and cross polarized antennas at UE

The values for parameters α_1 , α_2 , β and γ for high spatial correlation are given in Table B.2.3B.3-1.

Table B.2.3B.3-1

	High spatial correlation							
	α_1 α_2 β γ							
	0.9 0.9 0.9 0.3							
Note 1:	Note 1: Value of α_1 applies when more than one pair of cross-polarized antenna elements in first dimension at eNB side.							
Note 2:	Note 2: Value of α_2 applies when more than one pair of cross-polarized antenna elements in second dimension at eNB side.							
Note 3:	Note 3: Value of β applies when more than one pair of cross-polarized antenna elements at UE side.							

The correlation matrices for high spatial correlation are defined in Table B.2.3B.3-2 as below.

The values in Table B.2.3B.3-2 have been adjusted to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$\mathbf{R}_{high} = [\mathbf{R}_{spat} + aI_n]/(1+a)$$

where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 16(2,4,2)x2 high spatial correlation case, a=0.00012.

Table B.2.3B.3-2: MIMO correlation matrices for high spatial correlation

1,0000 0,0000 0,9740 0,0000 0,9740 0,0000 0,9000 0,0000 0,0000 0,8766 0,0000 0,9110 0,00000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000 0,0000		Table B.2.3B.3-2: MIMO correlation matrices for high spatial correlation
A		$R_{high} = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$, where
$A = D = \begin{bmatrix} 0.0000 & 0.9740 & 0.0000 & 1.0000 & 0.0000 & 0.9740 & 0.0000 & 0.9740 & 0.0000 & 0.9760 & 0.0000 & 0.9000 & 0.0000 & 0.9000 & 0.0000 & 0.9740 & 0.0000 & 0.0000 & 0.0000 & 0.9740 & 0.0000 & 0.0000 & 0.0000 & 0.9740 & 0.0000 & 0.0000 & 0.0000 & 0.9740 & 0.0000 & 0.0000 & 0.0000 & 0.9740 & 0.0000 & 0.9000 & 0.00000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.00000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.00000 & 0.0000 & 0.0000 & 0.0000 & 0.00000 & 0.00000 & 0.0000 & 0.00000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0$		
A=D=		
12(2,3,2)x2 Case		
12(2,3,2)x2 case 12(2,3,2)x2 case 10,0000 0,0000		0.0000 0.9000 0.0000 0.9740 0.0000 1.0000 0.0000 0.8100 0.0000 0.8766 0.0000 0.9000
12(2,3,2)x2 case 12(2,3,2)x2		0.9000 0.0000 0.8766 0.0000 0.8100 0.0000 1.0000 0.0000 0.9740 0.0000 0.9000 0.0000
12(2,3,2)x2 Case 0,0000 0,8766 0,0000 0,9900 0,0000 0,9740 0,0000 1,0000 0,0000 0,9740 0,0000 0,0000 0,9740 0,0000 0,0000 0,9740 0,0000 0,0000 0,0000 0,9740 0,0000 0,		
Case		
$B = C = \begin{bmatrix} -0.3000 & 0.0000 - 0.2922 & 0.0000 - 0.2700 & 0.0000 & 0.2760 & 0.0000 & 0.2430 & 0.0000 & 0.2430 \\ -0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2700 & 0.0000 & 0.2760 & 0.0000 & 0.2430 & 0.0000 & 0.2430 \\ -0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2730 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 \\ -0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2230 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 \\ -0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2430 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 \\ -0.0000 & 0.2700 & 0.0000 & 0.2230 & 0.0000 & 0.2430 & 0.0000 & 0.2300 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2430 & 0.0000 & 0.2430 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2430 & 0.0000 & 0.2430 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2922 & 0.0000 & 0.0$		0.8100 0.0000 0.8766 0.0000 0.9000 0.0000 0.9000 0.0000 0.9740 0.0000 1.0000 0.0000
### B=C	case	1
-0.2922 0.0000-0.3000 0.0000-0.2922 0.0000-0.2630 0.0000-0.2700 0.00000-0.2630 0.0000		
$B = C = \begin{bmatrix} 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2922 & 0.0000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2630 \\ -0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.0000 & 0.3000 & 0.0000 & 0.2430 & 0.0000 & 0.2630 & 0.0000 & 0.2700 \\ -0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2430 & 0.0000 & 0.2270 & 0.0000 \\ -0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2630 & 0.0000 & 0.3000 & 0.0000 & 0.0000 & 0.2922 & 0.0000 & 0.2700 \\ -0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2630 & 0.0000 & 0.2300 & 0.0000 & 0.3000 & 0.0000 & 0.2700 \\ -0.2430 & 0.0000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2000 \\ -0.0000 & 0.2430 & 0.0000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 \\ -0.0000 & 0.2430 & 0.0000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 \\ -0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9830 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8894 \\ -0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9891 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 \\ -0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9891 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 \\ -0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9884 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 \\ -0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9881 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 \\ -0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9881 & 0.0000 & 0.8894 & 0.0000 & 0.889$		
$B=C=\begin{bmatrix} 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2430 & 0.0000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.2700 & 0.00000 & 0.00000 & 0.00000 & 0.00000 & 0.00000 & 0.00000 & 0.0000 $		
$A = D = \begin{bmatrix} -0.2700 & 0.0000 - 0.2630 & 0.0000 - 0.2430 & 0.0000 & 0.0000 & 0.0000 & 0.2700 & 0.0000 & 0.2700 \\ -0.02630 & 0.00000 & 0.2700 & 0.0000 & 0.2630 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.2700 \\ -0.02630 & 0.00000 & 0.2700 & 0.0000 & 0.2630 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2922 \\ -0.2430 & 0.00000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2922 \\ -0.02430 & 0.00000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 & 0.2922 \\ -0.0000 & 0.2430 & 0.0000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 \\ -0.0000 & 0.2430 & 0.0000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 \\ -0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9841 & 0.0000 & 0.8990 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 & 0.0899 \\ -0.9822 & 0.0000 & 1.0000 & 0.0000 & 0.9811 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 \\ -0.0000 & 0.9882 & 0.0000 & 0.0982 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 \\ -0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 \\ -0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 \\ -0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 \\ -0.0000 & 0.9881 & 0.0000 & 0.9882 & 0.0000 & 0.0899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 \\ -0.0000 & 0.8894 & 0.0000 & 0.8891 & 0.0000 & 0.8899 & 0.0000 & 0.8891 & 0.0000 & 0.8891 & 0.0000 \\ -0.0000 & 0.8894 & 0.0000 & 0.8891 & 0.0000 & 0.8892 & 0.0000 & 0.8882 & 0.0000 & 0.9882 & 0.00$		-0.2700 0.0000-0.2922 0.0000-0.3000 0.0000-0.2430 0.0000-0.2630 0.0000-0.2700 0.0000
$A = D = \begin{cases} 0.0000 & 0.2700 & 0.0000 & 0.2630 & 0.0000 & 0.2430 & 0.0000 & 0.3000 & 0.0000 & 0.2922 & 0.0000 & 0.2700 & 0.0000 & 0.2630 & 0.0000 & 0.2530 & 0.0000 & 0.2922 & 0.0000 & 0.0000 & 0.0000 & 0.2922 & 0.0000 & 0.2922 & 0.0000 & 0.2922 & 0.0000 & 0.0000 & 0.2922 & 0.0000 & 0.0000 & 0.0000 & 0.2922 & 0.0000 & $		B=C=
$A = D = \begin{cases} -0.2630 & 0.0000 - 0.2700 & 0.0000 - 0.2630 & 0.0000 & 0.2922 & 0.0000 & 0.0000 & 0.2922 & 0.0000 \\ -0.0000 & 0.2630 & 0.00000 & 0.2700 & 0.00000 & 0.2922 & 0.0000 & 0.0000 & 0.0000 & 0.2922 \\ -0.2430 & 0.00000 - 0.2700 & 0.00000 & 0.2700 & 0.00000 & 0.2922 & 0.0000 & 0.3000 & 0.0000 \\ -0.0000 & 0.2430 & 0.0000 & 0.2630 & 0.00000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 \\ -0.0000 & 0.2430 & 0.0000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 \\ -0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9841 & 0.0000 & 0.8990 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 \\ -0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 \\ -0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 \\ -0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 \\ -0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.0000 & 0.0000 & 0.8894 & 0.0000 & 0.9882 & 0.0000 & 0.$		
$A = D = \begin{bmatrix} 0.0000 & 0.2430 & 0.0000 & 0.2630 & 0.0000 & 0.2700 & 0.0000 & 0.2922 & 0.0000 & 0.3000 \end{bmatrix} \\ R_{bight} = \begin{bmatrix} A & B \\ C & D \end{bmatrix}, \text{ where} \\ 0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 \\ 0.0000 & 1.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 \\ 0.0000 & 0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.9541 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 \\ 0.0000 & 0.9882 & 0.0000 & 1.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 \\ 0.0000 & 0.9882 & 0.0000 & 1.0000 & 0.0000 & 0.9882 & 0.0000 & 0.8894 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 \\ 0.0000 & 0.9894 & 0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8999 & 0.0000 \\ 0.0000 & 0.8999 & 0.0000 & 0.9541 & 0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.8587 & 0.0000 & 0.8894 & 0.0000 & 0.8999 & 0.0000 \\ 0.0000 & 0.8999 & 0.0000 & 0.9541 & 0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.8587 & 0.0000 & 0.8894 & 0.0000 & 0.8999 & 0.0000 \\ 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 & 0.0000 & 0.8892 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 \\ 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 & 0.8893 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 \\ 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 & 0.9882 & 0.0000 & 0.0982 & 0.0000 & 0.9882 & 0.0000 \\ 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 \\ 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 \\ 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 \\ 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 \\ 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & $		
$A=D= \begin{bmatrix} 1.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8887 & 0.0000 & 0.8099 & 0.0000 & 0.8894 & 0.0000 & 0.8887 & 0.0000 & 0.8099 & 0.0000 & 0.8894 & 0.0000 & 0.8887 & 0.0000 & 0.8099 & 0.0000 & 0.8894 & 0.0000 & 0.8887 & 0.0000 & 0.8898 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8892 & 0.0000 & 0.9882 & 0.0000 & 0.9411 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8897 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9881 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.9882 & 0.0000 & 0.0000 & 0.9882 & 0.0$		-0.2430 0.0000-0.2630 0.0000-0.2700 0.0000-0.2700 0.0000-0.2922 0.0000-0.3000 0.0000
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16(2,4,2)x2 case 16(2,4,2)x2 case 16(2,4,2)x2 case 16(2,4,2)x2 case 16(2,4,2)x2 case 16(2,4,2)x2 case 16(2,4,2)x2 case 16(2,4,2)x2 case 17(2,4,2)x2 case 18(2,4,2)x2		$A = D = \begin{bmatrix} 1.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 & 0.0000 \\ 0.0000 & 1.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8999 & 0.0000 & 0.8894 & 0.0000 & 0.8894 & 0.0000 & 0.8587 & 0.0000 & 0.8099 \\ 0.9882 & 0.0000 & 1.0000 & 0.0000 & 0.9882 & 0.0000 & 0.9541 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8894 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.9882 & 0.0000 & 0.8999 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & 0.8899 & 0.0000 & $
$B = C = \begin{bmatrix} -0.2965 & 0.0000 - 0.3000 & 0.0000 - 0.2965 & 0.0000 - 0.2862 & 0.0000 - 0.2668 & 0.0000 - 0.2700 & 0.0000 - 0.2668 & 0.0000 & 0.2576 & 0.0000 \\ -0.2862 & 0.0000 - 0.2965 & 0.0000 & 0.2965 & 0.0000 & 0.2862 & 0.0000 & 0.2668 & 0.0000 & 0.2700 & 0.0000 & 0.2668 & 0.0000 \\ -0.2862 & 0.0000 - 0.2965 & 0.0000 & 0.3000 & 0.0000 - 0.2965 & 0.0000 - 0.2576 & 0.0000 - 0.2668 & 0.0000 & 0.2700 & 0.0000 - 0.2668 & 0.0000 \\ -0.2700 & 0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 & 0.2576 & 0.0000 - 0.2576 & 0.0000 - 0.2668 & 0.0000 & 0.2700 & 0.0000 \\ -0.2700 & 0.0000 - 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.0000 & 0.2430 & 0.0000 - 0.2576 & 0.0000 - 0.2668 & 0.0000 & 0.2700 \\ -0.02700 & 0.0000 - 0.2668 & 0.0000 - 0.2576 & 0.0000 - 0.2430 & 0.0000 & 0.2576 & 0.0000 - 0.2862 & 0.0000 & 0.2700 \\ -0.2700 & 0.0000 - 0.2668 & 0.0000 & 0.2576 & 0.0000 - 0.2430 & 0.0000 & 0.2965 & 0.0000 & 0.2862 & 0.0000 & 0.2700 \\ -0.2668 & 0.0000 - 0.2700 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 & 0.2862 & 0.0000 \\ -0.2668 & 0.0000 - 0.2700 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -0.2576 & 0.0000 - 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 & 0.2965 \\ -0.2576 & 0.0000 - 0.2668 & 0.0000 & 0.2700 & 0.0000 & 0.2668 & 0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 & 0.2965 \\ -0.2576 & 0.0000 - 0.2668 & 0.0000 & 0.2700 & 0.0000 & 0.2668 & 0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -$		0.8587 0.0000 0.8894 0.0000 0.8899 0.0000 0.8894 0.0000 0.9882 0.0000 1.0000 0.0000
$ \left \begin{array}{cccccccccccccccccccccccccccccccccccc$		$B = C = \begin{bmatrix} 0.0000 & 0.3000 & 0.0000 & 0.2965 & 0.0000 & 0.2862 & 0.0000 & 0.2700 & 0.0000 & 0.2700 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 & 0.2430 \\ -0.2965 & 0.0000 & 0.3000 & 0.0000 & 0.2965 & 0.0000 & 0.2862 & 0.0000 & 0.2668 & 0.0000 & 0.2700 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 \\ -0.0000 & 0.2965 & 0.0000 & 0.3000 & 0.0000 & 0.2965 & 0.0000 & 0.2862 & 0.0000 & 0.2668 & 0.0000 & 0.2700 & 0.0000 & 0.2668 & 0.0000 \\ -0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.3000 & 0.0000 & 0.2965 & 0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2700 & 0.0000 & 0.2668 & 0.0000 \\ -0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.3000 & 0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2700 & 0.0000 \\ -0.0000 & 0.2700 & 0.0000 & 0.2965 & 0.0000 & 0.3000 & 0.0000 & 0.2430 & 0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2700 \\ -0.2700 & 0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.3000 & 0.0000 & 0.2430 & 0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2700 \\ -0.2700 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 & 0.2430 & 0.0000 & 0.2965 & 0.0000 & 0.2862 & 0.0000 & 0.2700 \\ -0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 & 0.2430 & 0.0000 & 0.2965 & 0.0000 & 0.2862 & 0.0000 & 0.2700 \\ -0.2668 & 0.0000 & 0.2700 & 0.0000 & 0.2576 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 & 0.2862 & 0.0000 \\ -0.0000 & 0.2668 & 0.0000 & 0.2700 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 & 0.2965 & 0.0000 & 0.3000 & 0.0000 & 0.2965 & 0.0000 \\ -0.0576 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2576 & 0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0000 & 0.2965 & 0.0000 \\ -0.0000 & 0.2576 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2668 & 0.0000 & 0.2862 & 0.0000 & 0.2965 & 0.0$

B.2.3B.4 Beam steering approach

Given the channel spatial correlation matrix in B.2.3B.1, the corresponding random channel matrix \mathbf{H} can be calculated. The signal model for the k-th subframe is denoted as

$$y = HD_{\theta_{k-1},\theta_{k-2}}Wx + n$$

And the steering matrix is further expressed as following:

$$D_{\theta_{k,1},\theta_{k,2}} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \left(D_{\theta_{k,1}}(N_1) \otimes D_{\theta_{k,2}}(N_2) \right)$$

where

- H is the Nr xNt channel matrix per subcarrier.
- $D_{\theta_{k,1},\theta_{k,2}}$ is the steering matrix,
- $D_{\theta_{-}}(N_1)$ is the steering matrix in first dimension with same polarization,
- $D_{\theta_{k,2}}(N_2)$ is the steering matrix in second dimension with same polarization,
- N_1 is the number of antenna elements infirst dimension with same polarization,
- N_2 is the number of antenna elements in second dimension with same polarization,

For 1 antenna element of the same polarization in one direction, $D_{\theta_{-}}(1) = 1$.

For 2 antenna elements of the same polarization in one direction, $D_{\theta_{k,i}}(2) = \begin{bmatrix} 1 & 0 \\ 0 & e^{j3\theta_{k,i}} \end{bmatrix}$.

For 3 antenna elements of the same polarization in one direction, $D_{\theta_{k,i}}(3) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & e^{j1.5\theta_{k,i}} & 0 \\ 0 & 0 & e^{j3\theta_{k,i}} \end{bmatrix}.$

For 4 antenna elements of the same polarization in one direction, $D_{\theta_{k,i}}(4) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & e^{j\theta_{k,i}} & 0 & 0 \\ 0 & 0 & e^{j2\theta_{k,i}} & 0 \\ 0 & 0 & 0 & e^{j3\theta_{k,i}} \end{bmatrix}.$

where the index i = 1,2 stands for first dimension and second dimension respectively.

- $\theta_{k,i}$ controls the phase variation in first dimension and second dimension respectively, and the phase for k-th subframe is denoted by $\theta_{k,i} = \theta_{0,i} + \Delta\theta \cdot k$, where $\theta_{0,i}$ is the random start value with the uniform distribution, i.e., $\theta_{0,i} \in [0,2\pi]$, $\Delta\theta$ is the step of phase variation, which is defined in Table B.2.3B.4-1, and k is the linear increment of 1 for every subframe throughout the simulation, the index i = 1,2 stands for first dimension and second dimension respectively.
- W is the precoding matrix for Nt transmission antennas,
- y is the received signal, x is the transmitted signal, and n is AWGN.

Table B.2.3B.4-1: The step of phase variation

Variation St	ep Value (rad/subframe)
$\Delta \theta$	1.2566×10 ⁻³

B.2.4 Propagation conditions for CQI tests

For Channel Quality Indication (CQI) tests, the following additional multi-path profile is used:

$$h(t,\tau) = \delta(\tau) + a \exp(-i2\pi f_D t)\delta(\tau - \tau_d),$$

in continuous time (t, τ) representation, with τ_d the delay, a a constant and f_D the Doppler frequency. The same $h(t, \tau)$ is used to describe the fading channel between every pair of Tx and Rx.

B.2.4.1 Propagation conditions for CQI tests with multiple CSI processes

For CQI tests with multiple CSI processes, the following additional multi-path profile is used for 2 port transmission:

$$H = \begin{bmatrix} 1 & j \\ 1 & -j \end{bmatrix} \circ H_{MP}$$

Where \circ represents Hadamard product, H_{MP} indicates the 2x2 propagation channel generated in the manner defined in Clause B.2.4.

B.2.5 Void

B.2.6 MBSFN Propagation Channel Profile

Table B.2.6-1 shows propagation conditions that are used for the MBSFN performance requirements in multi-path fading environment in an extended delay spread environment.

Table B.2.6-1: Propagation Conditions for Multi-Path Fading Environments for MBSFN Performance Requirements in an extended delay spread environment

Extended Delay Spread							
Maximum Doppler frequency [5Hz]							
Relative Delay [ns]	Relative Mean Power [dB]						
_							
0	0						
30	-1.5						
150	-1.4						
310	-3.6						
370	-0.6						
1090	-7.0						
12490	-10						
12520	-11.5						
12640	-11.4						
12800	-13.6						
12860	-10.6						
13580	-17.0						
27490	-20						
27520	-21.5						
27640	-21.4						
27800	-23.6						
27860	-20.6						
28580	-27.0						

B.3 High speed train scenario

The high speed train condition for the test of the baseband performance is a non fading propagation channel with one tap. Doppler shift is given by

$$f_s(t) = f_d \cos \theta(t) \tag{B.3.1}$$

where $f_s(t)$ is the Doppler shift and f_d is the maximum Doppler frequency. The cosine of angle $\theta(t)$ is given by

$$\cos \theta(t) = \frac{D_s/2 - vt}{\sqrt{D_{\min}^2 + (D_s/2 - vt)^2}}, \ 0 \le t \le D_s/v$$
(B.3.2)

$$\cos \theta(t) = \frac{-1.5D_s + vt}{\sqrt{D_{\min}^2 + (-1.5D_s + vt)^2}}, \ D_s/v < t \le 2D_s/v$$
(B.3.3)

$$\cos\theta(t) = \cos\theta(t \mod (2D_s/v)), \ t > 2D_s/v \tag{B.3.4}$$

where $D_s/2$ is the initial distance of the train from eNodeB, and D_{\min} is eNodeB Railway track distance, both in meters; v is the velocity of the train in m/s, t is time in seconds.

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Doppler shift and cosine angle are given by equation B.3.1 and B.3.2-B.3.4 respectively, where the required input parameters listed in table B.3-1 and the resulting Doppler shift shown in Figure B.3-1 are applied for all frequency bands.

Parameter	Value
D_s	300 m
D_{\min}	2 m
ν	300 km/h
f_d	750 Hz

Table B.3-1: High speed train scenario

NOTE 1: Parameters for HST conditions in table B.3-1 including f_d and Doppler shift trajectories presented on figure B.3-1 were derived from Band 7 and are applied for performance verification in all frequency bands.

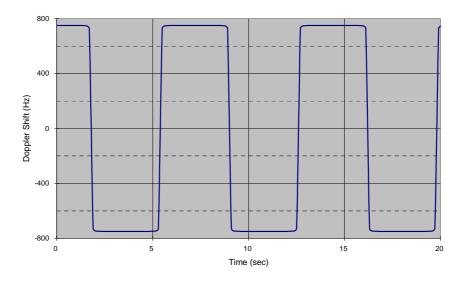


Figure B.3-1: Doppler shift trajectory

For 1x2 antenna configuration, the same $h(t,\tau)$ is used to describe the channel between every pair of Tx and Rx.

For 2x2 antenna configuration, the same $h(t,\tau)$ is used to describe the channel between every pair of Tx and Rx with phase shift according to $\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -i \end{pmatrix}$.

Beamforming Model B.4

Single-layer random beamforming (Antenna port 5, 7, or 8) B.4.1

Single-layer transmission on antenna port 5 or on antenna port 7 or 8 without a simultaneous transmission on the other antenna port, is defined by using a precoder vector W(i) of size 2×1 randomly selected with the number of layers

v=1 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input the signal $y^{(p)}(i)$, $i=0,1,...,M_{\mathrm{symb}}^{\mathrm{ap}}-1$, for antenna port $p\in\{5,7,8\}$, with $M_{\mathrm{symb}}^{\mathrm{ap}}$ the number of modulation symbols including the user-specific reference symbols (DRS), and generates a block of signals $y_{bf}(i)=[y_{bf}(i)\ \tilde{y}_{bf}(i)]^T$ the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W(i)y^{(p)}(i)$$

Single-layer transmission on antenna port 7 or 8 with a simultaneous transmission on the other antenna port, is defined by using a pair of precoder vectors $W_1(i)$ and $W_2(i)$ each of size 2×1 , which are not identical and randomly selected with the number of layers v=1 from Table 6.3.4.2.3-1 in [4], as beamforming weights, and normalizing the transmit power as follows:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = \frac{1}{\sqrt{2}} (W_1(i)y^{(7)}(i) + W_2(i)y^{(8)}(i))$$

The precoder update granularity is specific to a test case.

The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 1$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $y_{bf}(i)$. The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 0$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $\widetilde{y}_{bf}(i)$.

B.4.1A Single-layer random beamforming (Antenna port 7, 8, 11 or 13 with enhanced DMRS table configured)

Single-layer transmission on antenna port 11 with a simultaneous transmission on one antenna port from antenna port 7,8 or 13, is defined by using a pair of precoder vectors $W_1(i)$ and $W_2(i)$ each of size 2×1 , which are not identical and randomly selected with the number of layers v=1 from Table 6.3.4.2.3-1 in [4], as beamforming weights, and normalizing the transmit power as follows:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = \frac{1}{\sqrt{2}} (W_1(i) y^{(11)}(i) + W_2(i) y^{(p_1)}(i))$$

The precoders takes $y^{(11)}(i)$ and $y^{(p_1)}(i)$ as the input the signals, $i=0,1,...,M_{\rm symb}^{\rm ap}-1$, with $M_{\rm symb}^{\rm ap}$ the number of modulation symbols including the user-specific reference symbols (DM-RS), and generates a block of signals $y_{bf}(i) = \begin{bmatrix} y_{bf}(i) & \widetilde{y}_{bf}(i) \end{bmatrix}^T$ the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements.

The antenna port $p_1 \in \{7,8,13\}$ update granularity is specific to a test case.

The precoder update granularity is specific to a test case.

The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 1$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $y_{bf}(i)$. The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 0$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $\widetilde{y}_{bf}(i)$.

B.4.2 Dual-layer random beamforming (antenna ports 7 and 8)

Dual-layer transmission on antenna ports 7 and 8 is defined by using a precoder matrix W(i) of size 2×2 randomly selected with the number of layers v=2 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input a block of signals for antenna ports 7 and 8, $y(i) = \begin{bmatrix} y^{(7)}(i) & y^{(8)}(i) \end{bmatrix}^T$, $i=0,1,...,M_{\text{symb}}^{\text{ap}}-1$, with $M_{\text{symb}}^{\text{ap}}$ being the number of modulation symbols per antenna port including the user-specific reference symbols, and generates a block of signals $y_{bf}(i) = \begin{bmatrix} y_{bf}(i) & \tilde{y}_{bf}(i) \end{bmatrix}^T$ the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \end{bmatrix},$$

The precoder update granularity is specific to a test case.

The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 1$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $y_{bf}(i)$. The CSI reference symbols $a_{k,l}^{(p)}$ satisfying $p \mod 2 = 0$, $p \in \{15,16,...,22\}$, are transmitted on the same physical antenna element as the modulation symbols $\widetilde{y}_{bf}(i)$.

B.4.3 Generic beamforming model (antenna ports 7-14)

The transmission on antenna port(s) p=7,8,...,v+6 is defined by using a precoder matrix W(i) of size $N_{CSI} \times v$, where N_{CSI} is the number of CSI reference signals configured per test and v is the number of spatial layers. This precoder takes as an input a block of signals for antenna port(s) p=7,8,...,v+6, $y^{(p)}(i) = \begin{bmatrix} y^{(7)}(i) & y^{(8)}(i) & \cdots & y^{(6+v)}(i) \end{bmatrix}, i=0,1,...,M_{\text{symb}}^{\text{ap}}-1$, with $M_{\text{symb}}^{\text{ap}}$ being the number of modulation symbols per antenna port including the user-specific reference symbols (DM-RS), and generates a block of signals $y_{bf}^{(q)}(i) = \begin{bmatrix} y_{bf}^{(0)}(i) & y_{bf}^{(1)}(i) & \cdots & y_{bf}^{(N_{CSI}-1)}(i) \end{bmatrix}^T$ the elements of which are to be mapped onto the same time-frequency index pair (k,l) but transmitted on different physical antenna elements:

$$\begin{bmatrix} y_{bf}^{(0)}(i) \\ y_{bf}^{(1)}(i) \\ \vdots \\ y_{bf}^{(N_{CSI}-1)}(i) \end{bmatrix} = W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \\ \vdots \\ y^{(6+\nu)}(i) \end{bmatrix}$$

The precoder matrix W(i) is specific to a test case.

The physical antenna elements are identified by indices $j = 0,1,...,N_{ANT}-1$, where $N_{ANT} = N_{CSI}$ is the number of physical antenna elements configured per test.

Modulation symbols $y_{bf}^{(q)}(i)$ with $q \in \{0,1,...,N_{CSI}-1\}$ (i.e. beamformed PDSCH and DM-RS) are mapped to the physical antenna index j=q.

Modulation symbols $y^{(p)}(i)$ with $p \in \{0,1,...,P-1\}$ (i.e. PBCH, PDCCH, PHICH, PCFICH) are mapped to the physical antenna index j=p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols $a_{k,l}^{(p)}$ with $p \in \{0,1,...,P-1\}$ (i.e. CRS) are mapped to the physical antenna index j=p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols $a_{k,l}^{(p)}$ with $p \in \{15,16,...,14 + N_{CSI}\}$ (i.e. CSI-RS) are mapped to the physical antenna index j = p - 15, where N_{CSI} is the number of CSI reference signals configured per test.

B.4.4 Random beamforming for EPDCCH distributed transmission (Antenna port 107 and 109)

EPDCCH distributed transmission on antenna port 107 and antenna port 109 is defined by using a pair of precoder vectors $W_1(i)$ and $W_2(i)$ each of size 2×1 , which are not identical and randomly selected per EPDCCH PRB pair with the number of layers v=1 from Table 6.3.4.2.3-1 in [4], as beamforming weights. This precoder takes as an input the signal $y^{(p)}(i)$, $i=0,1,...,M_{\text{symb}}^{\text{ap}}-1$, for antenna port $p\in\{107,109\}$, with $M_{\text{symb}}^{\text{ap}}$ the number of modulation symbols including the user-specific reference symbols (DMRS), and generates a block of signals $y_{bf}(i)=[y_{bf}(i) \ \ \widetilde{y}_{bf}(i)]^T$. When EPDCCH is associated with port 107, the transmitted block of signals is deonted as

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W_1(i) y^{(107)}(i).$$

When EPDCCH is associated with port 109, the transmitted block of signals is denoted as

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W_2(i) y^{(109)}(i).$$

B.4.5 Random beamforming for EPDCCH localized transmission (Antenna port 107, 108, 109 or 110)

EPDCCH localized transmission on antenna port 107, 108, 109 or 110 is defined by using a precoder vector W(i) of size 2×1 randomly selected with the number of layers v=1 from Table 6.3.4.2.3-1 in [4] as beamforming weights. This precoder takes as an input the signal $y^{(p)}(i)$, $i=0,1,...,M_{\mathrm{symb}}^{\mathrm{ap}}-1$, for antenna port $p\in\{107,108,109,110\}$, with $M_{\mathrm{symb}}^{\mathrm{ap}}$ the number of modulation symbols including the user-specific reference symbols (DMRS), and generates a block of signals $y_{bf}(i)=\left[y_{bf}(i)\quad \widetilde{y}_{bf}(i)\right]^T$ the elements of which are to be mapped onto the same physical RE but transmitted on different antenna elements:

$$\begin{bmatrix} y_{bf}(i) \\ \widetilde{y}_{bf}(i) \end{bmatrix} = W(i)y^{(p)}(i).$$

B.4.6 Beamforming model for CRI test

The transmission on antenna port(s) $p=7,8,...,\upsilon+6$ is defined by using a precoder matrix W(i) of size $N_{CSI}\times\upsilon$, where N_{CSI} is the number of CSI reference signals configured per test and υ is the number of spatial layers. This precoder takes as an input a block of signals for antenna port(s) $p=7,8,...,\upsilon+6$, $y^{(p)}(i)=\left[y^{(7)}(i) \quad y^{(8)}(i) \quad \cdots \quad y^{(6+\upsilon)}(i)\right], \ i=0,1,...,M_{\mathrm{symb}}^{\mathrm{ap}}-1, \ \text{with} \ M_{\mathrm{symb}}^{\mathrm{ap}} \ \text{being the number of modulation}$ symbols per antenna port including the user-specific reference symbols (DM-RS), and generates a block of signals $y_{bf}^{(q)}(i)=\left[y_{bf}^{(0)}(i) \quad y_{bf}^{(1)}(i) \quad \ldots \quad y_{bf}^{(N_{CSI}-1)}(i)\right]^T$ the elements of which are to be mapped onto the same time-frequency index pair (k,l) but transmitted on different physical antenna elements:

$$\begin{bmatrix} y_{bf}^{(0)}(i) \\ y_{bf}^{(1)}(i) \\ \vdots \\ y_{bf}^{(N_{CSI}-1)}(i) \end{bmatrix} = \alpha(n)W(i) \begin{bmatrix} y^{(7)}(i) \\ y^{(8)}(i) \\ \vdots \\ y^{(6+\nu)}(i) \end{bmatrix}$$

- W(i) is precoder matrix
- $\alpha(n)$ is amplitude scaling factor for CRI test, $\alpha(n) = 10^{P_{\theta_m}(n)/20}$
- $P_{\theta_m}(n)$ is power scaling factor as following definition:

•
$$P_{\theta_m}(n) = A\cos\left(\theta_m + \frac{2\pi n}{K}\right) + B$$
, A = 5 dB, B = -1.3351 dB.

- θ_m controls the phase variation, and the phase for m-th subframe is denoted by $\theta_m = \theta_0 + \Delta\theta \cdot m$, where θ_0 is the random start value with the uniform distribution, i.e., $\theta_0 \in [0,2\pi]$, $\Delta\theta$ is the step of phase variation which is defined in Table B.4.6-1, and m is the linear increment of 1 for every sub-frame throughout the simulation.
- K is the number of configured CSI-RS resources
- $n \in \{0,1,...,K-1\}$
- For following CRI with multiple CSI-RS resources configured, n equals to CRI value reported by UE
- For fixed CRI with single CSI-RS resource configure, n equals to 0.

Table B.4.6-1: The step of phase variation

Variation Step	Value (rad/subframe)
$\Delta heta$	1.2566×10 ⁻³

The physical antenna elements are identified by indices $j = 0,1,...,N_{ANT}-1$, where $N_{ANT}=N_{CSI}$ is the number of physical antenna elements configured per test.

Modulation symbols $y_{bf}^{(q)}(i)$ with $q \in \{0,1,...,N_{CSI}-1\}$ (i.e. beamformed PDSCH and DM-RS) are mapped to the physical antenna index j=q.

For the k-th configured CSI-RS resource, modulation symbols $a_{k,l}^{(p)}$ with $p \in \{15,16,...,14+N_{CSI}\}$ (i.e. CSI-RS) are firstly multipled by amplitude scaling factor $\alpha(n)$ to generate power scaled symols $y_{k,l}^{(p)}$:

$$y_{k,l}^{(p)} = \alpha(n)a_{k,l}^{(p)}$$

- n equals to CSI-RS resource index (k-th)

And power scaled symols $y_{k,l}^{(p)}$ with $p \in \{15,16,...,14+N_{CSI}\}$ (i.e. power scaled CSI-RS) are mapped to the physical antenna index j=p-15, where N_{CSI} is the number of CSI reference signals configured per test.

Modulation symbols $y^{(p)}(i)$ with $p \in \{0,1,...,P-1\}$ (i.e. PBCH, PDCCH, PHICH, PCFICH) are mapped to the physical antenna index j=p, where P is the number of cell-specific reference signals configured per test.

Modulation symbols $a_{k,l}^{(p)}$ with $p \in \{0,1,...,P-1\}$ (i.e. CRS) are mapped to the physical antenna index j=p, where P is the number of cell-specific reference signals configured per test.

B.5 Interference models for enhanced performance requirements Type-A

This clause provides a description for the modelling of interfering cell transmissions for enhanced performance requirements Type-A including: definition of dominant interferer proportion, transmission mode 3, 4 and 9 type of interference modelling.

B.5.1 Dominant interferer proportion

Each interfering cell involved in enhanced performance requirements Type-A is characterized by its associated dominant interferer proportion (DIP) value:

$$DIP_i = \frac{\hat{I}_{or(i+1)}}{N_{oc}}$$

where is $\hat{I}_{or(i+1)}$ is the average received power spectral density from the i-th strongest interfering cell involved in the requirement scenario ($\hat{I}_{or(1)}$ is assumed to be the power spectral density associated with the serving cell) and

 $N_{oc}' = \sum_{j=2}^{N} \hat{I}_{or(j)} + N_{oc}$ where N_{oc} is the average power spectral density of a white noise source consistent with the

definition provided in subclause 3.2 and N is the total number of cells involved in a given requirement scenario.

B.5.2 Transmission mode 3 interference model

This subclause provides transmission mode 3 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth. Transmitted physical channels shall include PSS, SSS and PBCH.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For rank-1 transmission over a subband, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4].

For rank-2 transmission over a subband, precoding for spatial multiplexing with large delay CDD over two layers for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.2.2 of [4].

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

B.5.3 Transmission mode 4 interference model

This subclause provides transmission mode 4 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth according to the probabilities of occurrence. Transmitted physical channels shall include PSS, SSS and PBCH. Probabilities of occurrence in each subframe are as specified in the

requirement scenario. If the probabilities of occurrence in each subframe are not specified in the requirement scenario, as default, they are equal to 1.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For each subframe and CQI subband, a precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-1 of [4]. Note that codebook index 0 shall be excluded from random precoder selection when the number of layers is v = 2.

Precoding for spatial multiplexing with cell-specific reference signals for the number of antenna ports in the requirement scenario shall be applied to 16QAM randomly modulated layer symbols, as specified in subclause 6.3.4.2.1 of [4] with the selected precoding matrices for each subframe and each CQI subband.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

B.5.4 Transmission mode 9 interference model

This subclause provides transmission mode 9 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the entire PDSCH region and the full transmission bandwidth according to the probabilities of occurrence. Transmitted physical channels shall include PSS, SSS and PBCH. Probabilities of occurrence in each subframe are as specified in the requirement scenario. If the probabilities of occurrence in each subframe are not specified in the requirement scenario, as default, they are equal to 1.

For each subframe and each CQI subband as defined in subclause 7.2 of [6], a transmission rank shall be randomly determined independently from other CQI subbands as well as other interfering cells. Probabilities of occurrence of each possible transmission rank are as specified in the requirement scenario.

For each subframe and each CQI subband, a precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-2 of [4].

The generic beamforming model in subclause B.4.3 shall be applied assuming cell-specific reference signals and CSI reference signals as specified in the requirement scenario. Random precoding with selected rank and precoding matrices for each subframe and each CQI subband shall be applied to 16QAM randomly modulated layer symbols including the user-specific reference symbols over antenna port 7 when the rank is one and antenna ports 7, 8 when the rank is two.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

B.6 Interference models for enhanced performance requirements Type-B

This clause provides a description for the modelling of interfering cell transmissions for enhanced performance requirements Type-B including: transmission mode 2, 3, 4 and 9 type of interference modelling and a definition of the random interference model.

B.6.1 Transmission mode 2 interference model

This subclause provides transmission mode 2 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the PDSCH region as specified in subclause B.6.6. Transmitted physical channels shall include PSS, SSS and PBCH.

The MCS shall be randomly determined with probabilities of occurrence of each possible MCS as specified in subclause B.6.6.

Precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to the randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4].

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

B.6.2 Transmission mode 3 interference model

This subclause provides transmission mode 3 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the PDSCH region as specified in subclause B.6.6. Transmitted physical channels shall include PSS, SSS and PBCH.

The transmission rank shall be randomly determined for each user defined in section B.6.6 with probabilities of occurrence of each possible transmission rank as specified in subclause B.6.6.

The MCS shall be randomly determined with probabilities of occurrence of each possible MCS as specified in subclause B.6.6.

For rank-1 transmission, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to the randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4].

For rank-2 transmission, precoding for spatial multiplexing with large delay CDD over two layers for the number of antenna ports in the requirement scenario shall be applied to the randomly modulated layer symbols, as specified in subclause 6.3.4.2.2 of [4].

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

B.6.3 Transmission mode 4 interference model

This subclause provides transmission mode 4 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the PDSCH region as specified in subclause B.6.6. Transmitted physical channels shall include PSS, SSS and PBCH.

The transmission rank shall be randomly determined with probabilities of occurrence of each possible transmission rank as specified in subclause B.6.6.

The MCS shall be randomly determined with probabilities of occurrence of each possible MCS as specified in subclause B.6.6.

For each TTI, for each user defined in B.6.6, a single precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-1 of [4]. Note that codebook index 0 shall be excluded from random precoder selection when the number of layers is v = 2.

Precoding for spatial multiplexing with cell-specific reference signals for the number of antenna ports in the requirement scenario shall be applied to randomly modulated layer symbols, as specified in subclause 6.3.4.2.1 of [4] with the selected precoding matrices as specified in subclause B.6.6.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

B.6.4 Transmission mode 9 interference model

This subclause provides transmission mode 9 interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe, each interfering cell shall transmit randomly modulated data over the PDSCH region as specified in subclause B.6.6. Transmitted physical channels shall include PSS, SSS and PBCH.

The transmission rank shall be randomly determined with probabilities of occurrence of each possible transmission rank as specified in subclause B.6.6.

The MCS shall be randomly determined with probabilities of occurrence of each possible MCS as specified in subclause B.6.6.

For each TTI, for each user defined in B.6.6, a single precoding matrix for the number of layers v associated to the selected rank shall be selected randomly from Table 6.3.4.2.3-1 of [4]. Note that codebook index 0 shall be excluded from random precoder selection when the number of layers is v = 2.

The generic beamforming model in subclause B.4.3 shall be applied assuming cell-specific reference signals and CSI reference signals as specified in the requirement scenario. Random precoding with selected rank and precoding matrices for each subframe shall be applied to randomly modulated layer symbols including the user-specific reference symbols over antenna port 7 when the rank is one and antenna ports 7, 8 when the rank is two.

For each TTI, for each user defined in B.6.6, the scrambling ID value nSCID is randomly assigned from the set of {0,1}.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

B.6.5 CRS interference model

This subclause provides for the CRS interference modelling for each explicitly modelled interfering cell in the requirement scenario. In each subframe there is no PDSCH transmitted. Transmitted physical channels shall include PSS, SSS and PBCH.

For unallocated REs in the control region, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio for these REs shall be as defined for PDCCH in Annex C.3.2.

B.6.6 Random interference model

This subclause presents the interference model which defines the resource allocation, MCS and rank for the two interference cells. The model includes approximately 10% DTX on these interference cells. Table B.6.6-1 shows the resource allocation for four users in two different configurations for each of the two interferers. Table B.6.6-2 shows the resource allocation to be used for special subframes with TM9 interference. Table B.6.6-3 shows the probabilities for the MSC and rank for these users.

Table B.6.6-1: Resource allocation for the random interference model

Resource		Resource allocation for random interference model				
allocation	User	Resource	Bitmap for resource allocation (Note 1)			Probability
configurations Indexes	Index	allocation type	1st field bitmap	2nd field bitmap	3rd field bitmap	Frobability
Configuration 1	User 0	1	00	0	10101000101010	
	User 1	1	00	0	01010101010101	50%
	User 2	0	01001001001001			30%
	User 3	0	00100100100100			
Configuration 2	User 0	1	00	0	10101010101010	
	User 1	1	00	1	01010100010101	50%
	User 2	0	01001001001001		50%	
	User 3	0	00100100100100			

Note 1: The 1st, 2nd, and 3rd field bitmaps are only valid for resource allocation type 1 which was defined in [6].

Note 2: The resource allocation model is used for both 1st and 2nd interfering cells and the resource allocation is independent for each interfering cell.

Table B.6.6-2: Resource allocation for the random interference model for TM9 special subframes

Resource		Resource allocation for random interference model				
allocation	User	Resource	Bitmap for resource allocation (Note 1)			Probability
configurations Indexes	Index	allocation type	1st field bitmap	2nd field bitmap	3rd field bitmap	Frobability
Configuration 1	User 0	1	00	0	10101000101010	
	User 1	1	00	0	01010101000001	50%
	User 2	0	01001000001001001			30%
	User 3	0	00100100000100100			
Configuration 2	User 0	1	00	0	10101000101010	
	User 1	1	00	1	01010000010101	50%
	User 2	0	01001000001001001 00100100000100100		50%	
	User 3	0				

Note 1: The 1st, 2nd, and 3rd field bitmaps are only valid for resource allocation type 1 which was defined in [6].

Note 2: The resource allocation model is used for both 1st and 2nd interfering cells and the resource allocation is independent for each interfering cell.

Table B.6.6-3 MCS and rank configuration for the random interference model

MCS probability			Rank probability		
	MCS5	MCS14	MCS25	Rank 1	Rank 2
	50%	25%	25%	80%	20%
Note 1:	The MCS and rank should follow the probability indicated in the table randomly per UE per TTI.				
Note 2:	2: The probabilities for MCS and rank configuration are used for both 1 st and 2 nd interfering cells.				
	The MCS and rank configurations are independent for each interfering cell.				

B.7 Interference models for enhanced downlink control channel performance requirements Type A and B

This clause provides a description for the modelling of interfering cell transmissions for the enhanced downlink control channel performance requirements Type A and B.

B.7.1 PDCCH, PCFICH and PHICH interference model

This subclause provides a description of the interfering cell transmissions model for the enhanced PDCCH/PCFICH and PHICH downlink control channel performance requirements Type A and B under synchronous network scenarios.

The transmitted physical signals and channels shall include CRS, PSS, SSS, PBCH and PCFICH. The PDCCH and PHICH transmit signals are emulated as virtual PDCCH signals described further in the clause.

The PDCCH signals are modelled with a per control channel element (CCE) level granularity and have guaranteed 50% CCE resource loading in each subframe. For each subframe the set of active and inactive CCEs is derived in accordance to the following procedure:

- 1) All available CCEs for the PDCCH and PHICH are marked as CCE_0 , CCE_1 , ..., CCE_{N-1} .
- 2) For the given partial loading ratio X = 50% the numbers of active CCEs M_{Active} and inactive CCEs $M_{Inactive}$ are derived

$$M_{Inactive} = \lfloor N * (100 - X \%) \rfloor$$
$$M_{Active} = N - M_{Inactive}$$

- 3) The indexes of $M_{lnactive}$ inactive CCEs are randomly selected out of the full set of CCEs.
- 4) The remaining M_{Active} CCEs are assigned to be active.

No signals are transmitted in the REs corresponding to the inactive CCEs. The PDCCH signals are transmitted in the REs corresponding to the active CCEs. For PDCCH REs, precoding for transmit diversity for the number of antenna ports in the requirement scenario shall be applied to QPSK randomly modulated layer symbols, as specified in subclause 6.3.4.3 of [4]. The EPRE ratio of the PDCCH REs in the active CCEs shall be derived in accordance to the following procedure:

- 1) For each generated active i-th CCE the PDCCH power boosting level P(i) shall be randomly generated using the uniform distribution in the [Pmin, Pmax] range. The Pmin is equal to -6 dB, the Pmax is equal to 6 dB. The random values should be derived in the dB scale.
- 2) Additional power normalization is applied for each generated i-th PDCCH power boosting level:

$$P_{norm}(i) = P(i) - \alpha$$

where P(i) and $P_{norm}(i)$ are the PDCCH power boosting coefficients before and after normalization in the dB scale; the power normalization factor α is equal to 1.3 dB.

3) The normalized PDCCH power boosting coefficients $P_{norm}(i)$ are further applied to the PDCCH_RA and PDCCH_RB values to derive the EPRE ratio of the PDCCH signals transmitted in the REs corresponding the i-th CCE in each subframe.

B.8 Burst transmission models for Frame structure type 3

This clause provides a description for burst transmission models for Frame structure type 3.

B.8.1 Burst transmission model for one LAA SCell

One burst is defined as downlink transmissions which occupy one or more consecutive subframes. The burst transmission format is determined according to the steps below:

- 1) Select the number of subframes N randomly from a given set of the number of subframes S_1 with equal probability as the total length of burst transmission format. The length includes both occupied OFDM symbols and non-occupied OFDM symbols within the burst format. S_1 is given per test case.
- 2) If N is equal to 1, the subframe is set as fully occupied, otherwise:
 - For demodulation test, the starting position for the first subframe is randomly selected from OFDM symbol 0 and OFDM symbol 7 with equal probability. For CSI test, the starting position for the first subframe is OFDM symbol 0.
 - The configuration of occupied OFDM symbols in the last subframe is randomly selected from configuration set S_2 . S_2 is given per test case.

A uniform random variable from [0, 1] is generated. If the random variable is less than p which is given per test case.

- If both the last subframe of previous burst and first subframe of new burst format are fully occupied, start burst transmission after deferring one subframe from the last subframe of previous burst. Otherwise, start burst transmission at the end of last subframe of previous burst.

Otherwise, the burst transmission is muted and the muting duration is the same as the number of subframes for determined burst format.

Annex C (normative): Downlink Physical Channels

C.1 General

This annex specifies the downlink physical channels that are needed for setting a connection and channels that are needed during a connection.

C.2 Set-up

Table C.2-1 describes the downlink Physical Channels that are required for connection set up.

Table C.2-1: Downlink Physical Channels required for connection set-up

Physical Channel		
PBCH		
SSS		
PSS		
PCFICH		
PDCCH		
EPDCCH		
PHICH		
PDSCH		

C.3 Connection

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

C.3.1 Measurement of Receiver Characteristics

Unless otherwise stated, Table C.3.1-1 is applicable for measurements on the Receiver Characteristics (clause 7).

Table C.3.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Physical Channel	EPRE Ratio
PBCH	PBCH_RA = 0 dB
	PBCH_RB = 0 dB
PSS	$PSS_RA = 0 dB$
SSS	$SSS_RA = 0 dB$
PCFICH	PCFICH_RB = 0 dB
PDCCH	PDCCH_RA = 0 dB
	PDCCH_RB = 0 dB
PDSCH	PDSCH_RA = 0 dB
	PDSCH_RB = 0 dB
OCNG	OCNG_RA = 0 dB
	OCNG_RB = 0 dB

NOTE 1: No boosting is applied.

For measurements on cells in TDD Band 46, Table C.3.1-1a is applicable for measurements of Receiver Characteristics (clause 7).

Table C.3.1-1a: Downlink Physical Channels transmitted during a connection (TDD Band 46)

Physical Channel	EPRE Ratio	
DRS	NOTE 1	
PSS	$PSS_RA = 0 dB$	
SSS	$SSS_RA = 0 dB$	
PCFICH	PCFICH_RB = 0 dB	
PDCCH	$PDCCH_RA = 0 dB$	
	PDCCH_RB = 0 dB	
PDSCH	PDSCH_RA = 0 dB	
	PDSCH_RB = 0 dB	
OCNG	OCNG_RA = 0 dB	
	OCNG_RB = 0 dB	
NOTE 1: No boosting is applied.		

Table C.3.1-2: Power allocation for OFDM symbols and reference signals

Parameter	Unit	Value	Note
Transmitted power spectral density $I_{\it or}$	dBm/15 kHz	Test specific	1. I_{or} shall be kept constant throughout all OFDM symbols
Cell-specific reference		0 dB	
signal power ratio $E_{\it RS}$ / $I_{\it or}$			

C.3.2 Measurement of Performance requirements

Table C.3.2-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels, unless otherwise stated.

Table C.3.2-1: Downlink Physical Channels transmitted during a connection (FDD and TDD and Frame structure Type 3)

Physical Channel	EPRE Ratio
PBCH	PBCH_RA = ρ_A + σ
	PBCH_RB = ρ_B + σ
PSS	PSS_RA = 0 (Note 3)
SSS	SSS_RA = 0 (Note 3)
PCFICH	PCFICH_RB = ρ_B + σ
PDCCH	PDCCH_RA = ρ_A + σ
	PDCCH_RB = ρ_B + σ
EPDCCH	EPDCCH_RA = $\rho_A + \delta$
	EPDCCH_RB = $ρ_B+δ$
MPDCCH	MPDCCH_RA = ρ_A + δ
	MPDCCH_RB = $ρ_B+δ$
PDSCH	PDSCH_RA = ρ _A
	PDSCH_RB = ρ_B
PMCH	PMCH_RA = ρ _A
	PMCH_RB = ρ _B
MBSFN RS	MBSFN RS_RA = ρ _A
	MBSFN RS_RB = ρ _B
OCNG	OCNG_RA = ρ_A + σ
	OCNG_RB = ρ_B + σ

NOTE 1: $\rho_A = \rho_B = 0$ dB means no RS boosting.

NOTE 2: MBSFN RS and OCNG are not defined downlink physical channels in [4].

NOTE 3: Assuming PSS and SSS transmitted on a single antenna port.

NOTE 4: ρ_A , ρ_B , σ , and δ are test specific.

NOTE 5: Void.

NOTE 6: For Frame Structure Type 3, PBCH are not defined.

Table C.3.2-2: Power allocation for OFDM symbols and reference signals

Parameter	Unit	Value	Note
Total transmitted power spectral density I_{or}	dBm/15 kHz	Test specific	1. I_{or} shall be kept
spectral density T _{or}			constant throughout all OFDM symbols
Cell-specific reference		Test specific	Applies for antenna
signal power ratio $E_{\it RS}$ / $I_{\it or}$			port p
Energy per resource element EPRE		Test specific	1. The complex-valued symbols $y^{(p)}(i)$ and
			$a_{k,l}^{(p)}$ defined in [4] shall
			conform to the given
			EPRE value. 2. For TM8, TM9 and
			TM10 the reference point
			for EPRE is before the
			precoder in Annex B.4.

C.3.3 Aggressor cell power allocation for Measurement of Performance Requirements when ABS is Configured

For the performance requirements and channel state information reporting when ABS is configured, the power allocation for the physical channels of the aggressor cell in non-ABS and ABS is listed in Table C.3.3-1.

Table C.3.3-1: Downlink physical channels transmitted in aggressor cell when ABS is configured in this cell

Physical Channel	Parameters	Unit	EP	RE Ratio	
Physical Channel			Non-ABS	ABS	
PBCH	PBCH_RA	dB	ρΑ	Note 1	
PBCH	PBCH_RB	dB	ρв	Note 1	
PSS	PSS_RA	dB	ρΑ	Note 1	
SSS	SSS_RA	dB	ρΑ	Note 1	
PCFICH	PCFICH_RB	dB	ρв	Note 1	
PHICH	PHICH_RA	dB	ρΑ	Note 1	
PHICH	PHICH_RB	dB	ρв	Note 1	
PDCCH	PDCCH_RA	dB	ρΑ	Note 1	
FDCCH	PDCCH_RB	dB	ρв	Note 1	
PDSCH	PDSCH_RA	dB	N/A	Note 1	
PDSCH	PDSCH_RB	dB	N/A	Note 1	
OCNG	OCNG_RA	dB	ρΑ	Note 1	
CONG	OCNG_RB	dB	ρв	Note 1	
Note 1: -∞ dB is allocated for this channel in this test.					

Table C.3.3-2: Downlink physical channels transmitted in aggressor cell when ABS is configured in this cell when the CRS assistance information is provided

Physical Channel	Parameters	Unit	EP	RE Ratio
Physical Channel		Unit	Non-ABS	ABS
PBCH	PBCH_RA	dB	ρΑ	ρΑ
PBCH	PBCH_RB	dB	ρв	ρв
PSS	PSS_RA	dB	ρΑ	ρΑ
SSS	SSS_RA	dB	ρΑ	ρΑ
PCFICH	PCFICH_RB	dB	ρв	Note 1
PHICH	PHICH_RA	dB	ρΑ	Note 1
PHICH	PHICH_RB	dB	ρв	Note 1
PDCCH	PDCCH_RA	dB	ρΑ	Note 1
PDCCH	PDCCH_RB	dB	ρв	Note 1
PDSCH	PDSCH_RA	dB	N/A	Note 1
PDSCH	PDSCH_RB	dB	N/A	Note 1
OCNG	OCNG_RA	dB	ρΑ	Note 1
CONG	OCNG_RB	dB	ρв	Note 1
Note 1: -∞ dB is allocated for this channel in this test.				

C.3.4 Power Allocation for Measurement of Performance Requirements when Quasi Co-location Type B: same Cell ID

For the performance requirements related to quasi-colocation type B behaviour when transmission points share the same Cell ID, the power allocation for the physical channels of the serving cell is listed in Table C.3.4-1 and the power allocation for the physical channels of the cell transmitting PDSCH is listed in Table C.3.4-2

Table C.3.4-1: Downlink physical channels transmitted in the serving cell (TP1)

Physical Channel	EPRE Ratio
PBCH	PBCH_RA = ρ_A + σ
	PBCH_RB = ρ_B + σ
PSS	PSS_RA = 0 (Note 2)
SSS	$SSS_RA = 0 $ (Note 2)
PDSCH	PDSCH_RA = ρ _A
	PDSCH_RB = ρ _B
PCFICH	PCFICH_RB = ρ_B + σ
PDCCH	PDCCH_RA = ρ_A + σ
	PDCCH_RB = ρ_B + σ

NOTE 1: $\rho_A = \rho_B = 0$ dB means no RS boosting.

NOTE 2: Assuming PSS and SSS transmitted on a single antenna port.

NOTE 3: ρ_A , ρ_B and σ are test specific.

Table C.3.4-2: Downlink physical channels for the transmission point transmitting PDSCH (TP2)

Physical Channel	Value
PDSCH	Test Specific

C.3.5 Simplified CA testing method

For CA tests which require more than 16 independent faders, if a test system cannot support a throughput measurement with fading on all carriers simultaneously, the simplified CA testing method shall be used.

In the simplified CA testing method, the resulting propagation channel(s) shall be generated by considering a number of independent faders needed for one carrier and connecting them to the signal of randomly chosen carrier(s). The maximum number of channel faders on the test will be less than or equal to 16. The remaining carrier(s) shall be connected without a channel fader but with AWGN. The throughput is then collected only for the carrier(s) connected to channel faders.

In the simplified CA testing method, the test shall be repeated by choosing carrier(s) excluding already chosen carrier(s) until all the carrier(s) are tested under fading conditions. All the collected throughtputs from each carrier shall be compared against the reference value of the requirements.

All supported carriers shall be configured and activated during the test.

C.3.6 Measurement of Receiver Characteristics for Narrowband

For the performance requiremens for Narrowband IoT, the power allocation for the physical channels is listed in Table C.3.6-1

Table C.3.6-1: Downlink Physical Channels transmitted during a connection

Physical Channel	EPRE Ratio for one NRS antenna port	EPRE Ratio for two NRS antenna ports
NPBCH	0 dB	-3 dB
NPDCCH	0 dB	-3 dB
NPDSCH	0 dB	-3 dB
NPSS	0 dB	0 dB
NSSS	0 dB	0 dB

NOTE 1: Assuming NPSS and NSSS transmitted on one NRS antenna port.

Table C.3.6-2: Power allocation for OFDM symbols and reference signals

Parameter	Unit	Value	Note
Transmitted power spectral	dBm/15 kHz	Test specific	$I_{\it or}$ shall be kept
density I_{or}			constant throughout all OFDM symbols
Cell-specific reference		0 dB	Applicble for In-
signal power ratio			band operation
E_{CRS}/I_{or}			
Narrowband reference		0 dB	Applicble for Stand-
signal power			alone and Guard-
ratio $E_{\it NRS}$ / $I_{\it or}$			band operation
Narrowband refefence		0 dB	Applicable for In-
signal power over cell-			band operation
specific reference signal			
power $E_{\it NRS}$ / $E_{\it RS}$			

Annex D (normative): Characteristics of the interfering signal

D.1 General

Unless otherwise stated, when the channel bandwidth is wider or equal to 5MHz, a modulated 5MHz full bandwidth E-UTRA downlink signal and CW signal are used as interfering signals when RF performance requirements for E-UTRA UE receiver are defined. For channel bandwidths below 5MHz, the bandwidth of modulated interferer should be equal to bandwidth of the received signal.

For Band 46, the bandwidth of interfering signal is 20MHz when RF performance requirements for E-UTRA UE receiver are defined.

D.2 Interference signals

Table D.2-1 describes the modulated interferer for different channel bandwidth options.

Table D.2-1: Description of modulated E-UTRA interferer

	Channel bandwidth					
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
BWInterferer	1.4 MHz	3 MHz	5 MHz	5 MHz	5 MHz	5 MHz
RB	6	15	25	25	25	25

Table D.2-2 describes the modulated interferer setting 2 for different channel bandwidth options for Band 46.

Table D.2-2: Description of modulated E-UTRA interferer for Band 46

	Channel bandwidth					
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
BWInterferer						20 MHz
RB						100

Annex E (normative): Environmental conditions

E.1 General

This normative annex specifies the environmental requirements of the UE. Within these limits the requirements of the present documents shall be fulfilled.

E.2 Environmental

The requirements in this clause apply to all types of UE(s).

E.2.1 Temperature

The UE shall fulfil all the requirements in the full temperature range of:

Table E.2.1-1

+15°C to +35°C	for normal conditions (with relative humidity of 25 % to 75 %)	
-10°C to +55°C	for extreme conditions (see IEC publications 68-2-1 and 68-2-2)	

Outside this temperature range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation.

E.2.2 Voltage

The UE shall fulfil all the requirements in the full voltage range, i.e. the voltage range between the extreme voltages.

The manufacturer shall declare the lower and higher extreme voltages and the approximate shutdown voltage. For the equipment that can be operated from one or more of the power sources listed below, the lower extreme voltage shall not be higher, and the higher extreme voltage shall not be lower than that specified below.

Table E.2.2-1

Power source	Lower extreme voltage	Higher extreme voltage	Normal conditions voltage
AC mains	0,9 * nominal	1,1 * nominal	nominal
Regulated lead acid battery	0,9 * nominal	1,3 * nominal	1,1 * nominal
Non regulated batteries:			
Leclanché	0,85 * nominal	Nominal	Nominal
Lithium	0,95 * nominal	1,1 * Nominal	1,1 * Nominal
Mercury/nickel & cadmium	0,90 * nominal		Nominal

Outside this voltage range the UE if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 for extreme operation. In particular, the UE shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

E.2.3 Vibration

The UE shall fulfil all the requirements when vibrated at the following frequency/amplitudes.

Table E.2.3-1

Frequency	ASD (Acceleration Spectral Density) random vibration		
5 Hz to 20 Hz	$0.96 \text{ m}^2/\text{s}^3$		
20 Hz to 500 Hz	0,96 m ² /s ³ at 20 Hz, thereafter –3 dB/Octave		

Outside the specified frequency range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in TS 36.101 for extreme operation.

Annex F (normative): Transmit modulation

F.1 Measurement Point

Figure F.1-1 shows the measurement point for the unwanted emission falling into non-allocated RB(s) and the EVM for the allocated RB(s).

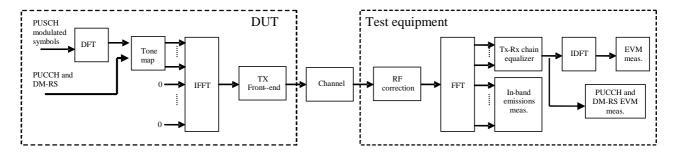


Figure F.1-1: EVM measurement points

F.2 Basic Error Vector Magnitude measurement

The EVM is the difference between the ideal waveform and the measured waveform for the allocated RB(s)

$$EVM = \sqrt{\frac{\sum_{v \in T_m} |z'(v) - i(v)|^2}{|T_m| \cdot P_0}},$$

where

 T_m is a set of $|T_m|$ modulation symbols with the considered modulation scheme being active within the measurement period,

z'(v) are the samples of the signal evaluated for the EVM,

i(v) is the ideal signal reconstructed by the measurement equipment, and

 P_0 is the average power of the ideal signal. For normalized modulation symbols P_0 is equal to 1.

The basic EVM measurement interval is defined over one slot in the time domain for PUCCH and PUSCH and over one preamble sequence for the PRACH.

F.3 Basic in-band emissions measurement

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks. The in-band emission requirement is evaluated for PUCCH and PUSCH transmissions. The in-band emission requirement is not evaluated for PRACH transmissions.

The in-band emissions are measured as follows

$$Emissions_{absolute}(\Delta_{RB}) = \begin{cases} \frac{1}{|T_{s}|} \sum_{t \in T_{s}} \sum_{\substack{\max(f_{\min}, f_{l} + 12 \cdot \Delta_{RB} * \Delta f) \\ \min(f_{\max}, f_{h} + 12 \cdot \Delta_{RB} * \Delta f)}} |Y(t, f)|^{2}, \Delta_{RB} < 0 \\ \frac{1}{|T_{s}|} \sum_{t \in T_{s}} \sum_{\substack{f_{h} + (12 \cdot \Delta_{RB} - 11) * \Delta f \\ f_{h} + (12 \cdot \Delta_{RB} - 11) * \Delta f}} |Y(t, f)|^{2}, \Delta_{RB} > 0 \end{cases}$$

where

 T_s is a set of $|T_s|$ SC-FDMA symbols with the considered modulation scheme being active within the measurement period,

 Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ or $\Delta_{RB}=-1$ for the first adjacent RB),

 f_{\min} (resp. f_{\max}) is the lower (resp. upper) edge of the UL system BW,

 f_l and f_h are the lower and upper edge of the allocated BW, and

Y(t, f) is the frequency domain signal evaluated for in-band emissions as defined in the subsection (ii)

The relative in-band emissions are, given by

$$Emissions_{relative}(\Delta_{RB}) = \frac{Emissions_{absolute}(\Delta_{RB})}{\frac{1}{|T_s| \cdot N_{RB}} \sum_{t \in T} \sum_{f_s}^{f_t + (12:N_{RB} - 1)\Delta f} |Y(t, f)|^2}$$

where

 N_{RR} is the number of allocated RBs

The basic in-band emissions measurement interval is defined over one slot in the time domain. When the PUSCH or PUCCH transmission slot is shortened due to multiplexing with SRS, the in-band emissions measurement interval is reduced by one SC-FDMA symbol, accordingly.

In the evaluation of in-band emissions, the timing is set according to $\Delta \widetilde{t} = \Delta \widetilde{c}$, where sample time offsets $\Delta \widetilde{t}$ and $\Delta \widetilde{c}$ are defined in subclause F.4.

F.4 Modified signal under test

Implicit in the definition of EVM is an assumption that the receiver is able to compensate a number of transmitter impairments.

The PUSCH data or PRACH or Physical Sidelink Channel signal under test is modified and, in the case of PUSCH or Physical Sidelink Channel data signal, decoded according to:

$$Z'(t,f) = IDFT \left\{ \frac{FFT \left\{ z(v - \Delta \widetilde{t}) \cdot e^{-j2\pi \Delta \widetilde{f}v} \right\} e^{j2\pi f\Delta \widetilde{t}}}{\widetilde{a}(t,f) \cdot e^{j\widetilde{\varphi}(t,f)}} \right\}$$

where

z(v) is the time domain samples of the signal under test.

The PUCCH or PUSCH or Physical Sidelink Channel demodulation reference signal or PUCCH data signal under test is equalised and, in the case of PUCCH data signal decoded according to:

$$Z'(t,f) = \frac{FFT\left\{z(v - \Delta \tilde{t}) \cdot e^{-j2\pi\Delta \tilde{f}v}\right\}e^{j2\pi j\Delta \tilde{t}}}{\tilde{a}(t,f) \cdot e^{j\tilde{\varphi}(t,f)}}e^{j2\pi j\Delta \tilde{t}}$$

where

z(v) is the time domain samples of the signal under test.

To minimize the error, the signal under test should be modified with respect to a set of parameters following the procedure explained below.

Notation:

 $\Delta \tilde{t}$ is the sample timing difference between the FFT processing window in relation to nominal timing of the ideal signal.

 $\Delta \tilde{f}$ is the RF frequency offset.

 $\widetilde{\varphi}(t,f)$ is the phase response of the TX chain.

 $\tilde{a}(t, f)$ is the amplitude response of the TX chain.

In the following $\Delta \tilde{c}$ represents the middle sample of the EVM window of length W (defined in the next subsections) or the last sample of the first window half if W is even.

The EVM analyser shall

- \triangleright detect the start of each slot and estimate $\Delta \widetilde{t}$ and $\Delta \widetilde{f}$,
- \blacktriangleright determine $\Delta \tilde{c}$ so that the EVM window of length W is centred
 - on the time interval determined by the measured cyclic prefix minus 16 samples of the considered OFDM symbol for symbol 0 for normal CP, i.e. the first 16 samples of the CP should not be taken into account for this step. In the determination of the number of excluded samples, a sampling rate of 30.72MHz was assumed. If a different sampling rate is used, the number of excluded samples is scaled linearly.
 - on the measured cyclic prefix of the considered OFDM symbol symbol for symbol 1 to 6 for normal CP and for symbol 0 to 5 for extended CP.
 - on the measured preamble cyclic prefix for the PRACH

To determine the other parameters a sample timing offset equal to $\Delta \tilde{c}$ is corrected from the signal under test. The EVM analyser shall then

- ightharpoonup correct the RF frequency offset $\Delta \widetilde{f}$ for each time slot, and
- > apply an FFT of appropriate size. The chosen FFT size shall ensure that in the case of an ideal signal under test, there is no measured inter-subcarrier interference.

The carrier leakage shall be removed from the evaluated signal before calculating the EVM and the in-band emissions; however, the removed relative carrier leakage power also has to satisfy the applicable requirement.

At this stage the allocated RBs shall be separated from the non-allocated RBs. In the case of PUCCH and PUSCH EVM, the signal on the non-allocated RB(s), Y(t, f), is used to evaluate the in-band emissions.

Moreover, the following procedure applies only to the signal on the allocated RB(s).

- In the case of PUCCH and PUSCH and Physical Sidelink Channel, the UL EVM analyzer shall estimate the TX chain equalizer coefficients $\tilde{a}(t,f)$ and $\tilde{\varphi}(t,f)$ used by the ZF equalizer for all subcarriers by time averaging at each signal subcarrier of the amplitude and phase of the reference and data symbols. The time-averaging length is 1 slot. This process creates an average amplitude and phase for each signal subcarrier used by the ZF equalizer. The knowledge of data modulation symbols may be required in this step because the determination of symbols by demodulation is not reliable before signal equalization.
- In the case of PRACH, the UL EVM analyzer shall estimate the TX chain coefficients $\widetilde{a}(t)$ and $\widetilde{\varphi}(t)$ used for phase and amplitude correction and are seleted so as to minimize the resulting EVM. The TX chain coefficients are not dependent on frequency, i.e. $\widetilde{a}(t,f) = \widetilde{a}(t)$ and $\widetilde{\varphi}(t,f) = \widetilde{\varphi}(t)$. The TX chain coefficient are chosen independently for each preamble transmission and for each $\Delta \widetilde{t}$.

At this stage estimates of $\Delta \widetilde{f}$, $\widetilde{a}(t,f)$, $\widetilde{\varphi}(t,f)$ and $\Delta \widetilde{c}$ are available. $\Delta \widetilde{t}$ is one of the extremities of the window W, i.e. $\Delta \widetilde{t}$ can be $\Delta \widetilde{c} + \alpha - \left\lfloor \frac{W}{2} \right\rfloor$ or $\Delta \widetilde{c} + \left\lfloor \frac{W}{2} \right\rfloor$, where $\alpha = 0$ if W is odd and $\alpha = 1$ if W is even. The EVM analyser shall then

- ightharpoonup calculate EVM₁ with $\Delta \tilde{t}$ set to $\Delta \tilde{c} + \alpha \left| \frac{W}{2} \right|$,
- ightharpoonup calculate EVM_h with $\Delta \tilde{t}$ set to $\Delta \tilde{c} + \left\lfloor \frac{W}{2} \right\rfloor$.

F.5 Window length

F.5.1 Timing offset

As a result of using a cyclic prefix, there is a range of $\Delta \tilde{t}$, which, at least in the case of perfect Tx signal quality, would give close to minimum error vector magnitude. As a first order approximation, that range should be equal to the length of the cyclic prefix. Any time domain windowing or FIR pulse shaping applied by the transmitter reduces the $\Delta \tilde{t}$ range within which the error vector is close to its minimum.

F.5.2 Window length

The window length W affects the measured EVM, and is expressed as a function of the configured cyclic prefix length. In the case where equalization is present, as with frequency domain EVM computation, the effect of FIR is reduced. This is because the equalization can correct most of the linear distortion introduced by the FIR. However, the time domain windowing effect can't be removed.

F.5.3 Window length for normal CP

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for normal CP. The nominal window length for 3 MHz is rounded down one sample to allow the window to be centered on the symbol.

Table F.5.3-1 EVM window length for normal CP

Channel Bandwidth MHz	Cyclic prefix length N_{cp} for symbol 0	$\begin{array}{c} \textbf{Cyclic prefix}\\ \textbf{length}^{\textbf{1}}\\ N_{cp} \textbf{ for}\\ \textbf{symbols 1 to 6} \end{array}$	Nominal FFT size	Cyclic prefix for symbols 1 to 6 in FFT samples	EVM window length W in FFT samples	Ratio of W to CP for symbols 1 to 6 ²
1.4		144	128	9	5	55.6
3			256	18	12	66.7
5	160		512	36	32	88.9
10	160		1024	72	66	91.7
15			1536	108	102	94.4
20			2048	144	136	94.4

Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed.

Note 2: These percentages are informative and apply to symbols 1 through 6. Symbol 0 has a longer CP and therefore a lower percentage.

F.5.4 Window length for Extended CP

The table below specifies the EVM window length at channel bandwidths 1.4, 3, 5, 10, 15, 20 MHz, for extended CP. The nominal window lengths for 3 MHz and 15 MHz are rounded down one sample to allow the window to be centered on the symbol.

Table F.5.4-1 EVM window length for extended CP

Channel Bandwidth MHz	$\begin{array}{c} \text{Cyclic} \\ \text{prefix} \\ \text{length}^{\text{1}} N_{cp} \end{array}$	Nominal FFT size	Cyclic prefix in FFT samples	EVM window length W in FFT samples	Ratio of W to CP ²
1.4		128	32	28	87.5
3		256	64	58	90.6
5	512	512	128	124	96.9
10	312	1024	256	250	97.4
15		1536	384	374	97.4
20		2048	512	504	98.4

Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed.

Note 2: These percentages are informative

F.5.5 Window length for PRACH

The table below specifies the EVM window length for PRACH preamble formats 0-4.

Table F.5.5-1 EVM window length for PRACH

Preamble format	$\begin{array}{c} \textbf{Cyclic}\\ \textbf{prefix}\\ \textbf{length}^{\textbf{1}}\\ N_{cp} \end{array}$	Nominal FFT size ²	EVM window length W in FFT samples	Ratio of W to CP*
0	3168	24576	3072	96.7%
1	21024	24576	20928	99.5%
2	6240	49152	6144	98.5%
3	21024	49152	20928	99.5%
4	448	4096	432	96.4%

Note 1: The unit is number of samples, sampling rate of 30.72MHz is assumed

Note 2: The use of other FFT sizes is possible as long as appropriate scaling of the window length is applied

Note 3: These percentages are informative

F.5.F Window length for category NB1

The EVM window length, W, for NPUSCH is set to 1 (in FFT samples where the nominal FFT size is 128 for 15 kHz sub-carrier spacing and 512 for 3.75 kHz sub-carrier spacing).

The EVM window length, W, for NPRACH is set to 110 for preamble format 0 and to 494 for preamble format 1 (both in FFT samples where the nominal FFT size is 512).

F.6 Averaged EVM

The general EVM is averaged over basic EVM measurements for n slots in the time domain.

$$\overline{EVM} = \sqrt{\frac{1}{n} \sum_{i=1}^{n} EVM_{i}^{2}},$$

where n is

n = 20 for PUCCH, PUSCH, PSDCH, PSCCH, and PSSCH,

n = 48 for PBSCH.

The EVM requirements shall be tested against the maximum of the RMS average at the window W extremities of the EVM measurements:

Thus $\overline{\text{EVM}}_1$ is calculated using $\Delta \tilde{t} = \Delta \tilde{t}_l$ in the expressions above and $\overline{\text{EVM}}_h$ is calculated using $\Delta \tilde{t} = \Delta \tilde{t}_h$.

Thus we get:

$$EVM = \max(\overline{EVM}_1, \overline{EVM}_h)$$

The calculation of the EVM for the demodulation reference signal, EVM_{DMRS} , follows the same procedure as calculating the general EVM, with the exception that the modulation symbol set T_m defined in clause F.2 is restricted to symbols containing uplink demodulation reference signals.

The basic EVM_{DMRS} measurements are first averaged over 20 slots in the time domain to obtain an intermediate average EVM_{DMRS} .

$$\overline{EVM}_{DMRS} = \sqrt{\frac{1}{20} \sum_{i=1}^{20} EVM_{DMRS,i}^2}$$

In the determination of each $EVM_{DMRS,i}$, the timing is set to $\Delta \widetilde{t} = \Delta \widetilde{t}_l$ if $\overline{EVM}_l > \overline{EVM}_h$, and it is set to $\Delta \widetilde{t} = \Delta \widetilde{t}_h$ otherwise, where \overline{EVM}_l and \overline{EVM}_h are the general average EVM values calculated in the same 20 slots over which the intermediate average \overline{EVM}_{DMRS} is calculated. Note that in some cases, the general average EVM may be calculated only for the purpose of timing selection for the demodulation reference signal EVM.

Then the results are further averaged to get the EVM for the demodulation reference signal, EVM_{DMRS} ,

$$EVM_{DMRS} = \sqrt{\frac{1}{6} \sum_{i=1}^{6} \overline{EVM}_{DMRS,j}^{2}}$$

The PRACH EVM, EVM_{PRACH} , is averaged over two preamble sequence measurements for preamble formats 0, 1, 2, 3, and it is averaged over 10 preamble sequence measurements for preamble format 4.

The EVM requirements shall be tested against the maximum of the RMS average at the window W extremities of the EVM measurements:

Thus
$$\overline{\text{EVM}}_{\text{PRACH,1}}$$
 is calculated using $\Delta \widetilde{t} = \Delta \widetilde{t}_l$ and $\overline{\text{EVM}}_{\text{PRACH,h}}$ is calculated using $\Delta \widetilde{t} = \Delta \widetilde{t}_h$.

Thus we get:

$$EVM_{PRACH} = \max(\overline{EVM}_{PRACH,1}, \overline{EVM}_{PRACH,h})$$

F.6.F Averaged EVM for category NB1

The general EVM for category NB1 is calculated using the procedure defined in Annex F.6 with the exception that the general EVM is averaged over basic EVM measurements for $240/L_{Ctone}$ slots in the time domain, where $L_{Ctone} = \{1, 3, 6, 12\}$ is the number of subcarriers for the transmission.

The calculation of the EVM for the demodulation reference symbols for category NB1 follows the procedure defined for DMRS in Annex F.6 with the exception that the basic EVM_{DMRS} measurements are first averaged over $240/L_{Ctone}$ slots to obtain the intermediate average EVM.

The calculation of the NPRACH EVM for both formats follows the procedure defined for PRACH in Annex F.6 with the exception that *EVM* PRACH is averaged over 64 preamble measurements.

F.7 Spectrum Flatness

The data shall be taken from FFT coded data symbols and the demodulation reference symbols of the allocated resource block.

Annex G (informative): Reference sensitivity level in lower SNR

This annex contains information on typical receiver sensitivity when HARQ transmission is enabled allowing operation in lower SNR regions (HARQ is disabled in conformance testing), thus representing the configuration normally used in live network operation under noise-limited conditions.

G.1 General

The reference sensitivity power level P_{SENS} with HARQ retransmission enabled (operation in lower SNR) is the minimum mean power applied to both the UE antenna ports at which the residual BLER after HARQ shall meet the requirements for the specified reference measurement channel. The residual BLER after HARQ transmission is defined as follows:

$$BLER_{residual} = 1 - \frac{A}{B}$$

A: Number of correctly decoded MAC PDUs

B: Number of transmitted MAC PDUs (Retransmitted MAC PDUs are not counted)

G.2 Typical receiver sensitivity performance (QPSK)

The residual BLER after HARQ shall be lower than 1% for the reference measurement channels as specified in Annexes G.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table G.2-1 and Table G.2-2

Table G.2-1: Reference sensitivity QPSK PSENS

			annel bar	ndwidth			
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
1				[-102]			FDD
2				TBD			FDD
3				TBD			FDD
4				TBD			FDD
5				TBD			FDD
6				TBD			FDD
7				TBD			FDD
8				TBD			FDD
9				TBD			FDD
10				TBD			FDD
11				TBD			FDD
12				TBD			FDD
13				TBD			FDD
14				TBD			FDD
17				TBD			FDD
18				TBD			FDD
19				TBD			FDD
20				TBD			FDD
21				TBD			FDD
22				TBD			FDD
23				TBD			FDD
26				TBD			FDD
27				TBD			FDD
28				TBD			FDD
30				TBD			FDD
31			TBD				FDD
33				[-102]			TDD
34				[-102]			TDD
35				[-102]			TDD
36				[-102]			TDD
37				[-102]			TDD
38				[-102]			TDD
39				[-102]			TDD
40				[-102]			TDD
42				[-102]			TDD
43				[-102]			TDD
44				[-102]			TDD
45				[-102]			TDD
65				TBD			FDD

Note 1: The transmitter shall be set to P_{UMAX} as defined in clause 6.2.5

Note 2: Reference measurement channel is G.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1

Note 3: The signal power is specified per port

Note 4: For the UE which supports both Band 3 and Band 9 the reference sensitivity level is FFS.

Note 5: For the UE which supports both Band 11 and Band 21 the reference sensitivity level is FFS.

Table G.2-2 specifies the minimum number of allocated uplink resource blocks for which the reference receive sensitivity requirement in lower SNR must be met.

Table G.2-2: Minimum uplink configuration for reference sensitivity

E-UTRA Band	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex Mode
1				[6] ¹			FDD
2				[6] ¹			FDD
3				[6] ¹			FDD
4				[6] ¹			FDD
5				[6] ¹			FDD
6				[6] ¹			FDD
7				[6] ¹			FDD
8				[6] ¹			FDD
9				[6] ¹			FDD
10				[6] ¹			FDD
11				[6] ¹			FDD
12				[6] ¹			FDD
13				[6] ¹			FDD
14				[6] ¹			FDD
17				[6] ¹			FDD
18				[6] ¹			FDD
19				[6] ¹			FDD
20				[6] ¹			FDD
22				[6] ¹			FDD
21				[6] ¹			FDD
23				[6] ¹			FDD
26				[6] ¹			FDD
27				[6] ¹			FDD
28				[6] ¹			FDD
30				[6] ¹			FDD
31			[5] ⁴				FDD
33				50			TDD
34				50			TDD
35				50			TDD
36				50			TDD
37				50			TDD
38				50			TDD
39				50			TDD
40				50			TDD
42				50			TDD
43				50			TDD
44				50			TDD
45				50			TDD
65				[6] ¹			FDD
(The UL reso downlink op configuration	erating ba	and but co	nfined with	in the trans	smission ba	

Note 2: For the UE which supports both Band 11 and Band 21 the minimum uplink configuration for reference sensitivity is FFS.

Note 3: For Band 20; in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RBstart _11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RBstart _16

Note 4: For Band 31; in the case of 5MHz channel bandwidth, the UL resource

blocks shall be located at RBstart _10

Unless given by Table G.2-3, the minimum requirements specified in Tables G.2-1 and G.2-2 shall be verified with the network signalling value NS_01 (Table 6.2.4-1) configured.

Table G.2-3: Network Signalling Value for reference sensitivity

E-UTRA Band	Network Signalling value
2	NS_03
4	NS_03
10	NS_03
12	NS_06
13	NS_06
14	NS_06
17	NS_06
19	NS_08
21	NS_09
23	NS_03
30	NS_21
35	NS_03
36	NS_03

G.3 Reference measurement channel for REFSENSE in lower SNR

Tables G.3-1 and G.3-2 are applicable for Annex G.2 (Reference sensitivity level in lower SNR).

Table G.3-1 Fixed Reference Channel for Receiver Requirements (FDD)

Parameter	Unit	Value
Channel bandwidth	MHz	5 10
Allocated resource blocks		25 50
Subcarriers per resource block		12 12
Allocated subframes per Radio Frame		9 9
Modulation		QPSK QPSK
Target Coding Rate		1/3 1/3
Number of HARQ Processes	Processes	8 8
Maximum number of HARQ transmissions		[4] [4]
Information Bit Payload per Sub-Frame		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	2216 4392
For Sub-Frame 5	Bits	N/A N/A
For Sub-Frame 0	Bits	1800 4392
Transport block CRC	Bits	24 24
Number of Code Blocks per Sub-Frame		
(Note 4)		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	1 1 1
For Sub-Frame 5	Bits	N/A N/A
For Sub-Frame 0	Bits	1 1
Binary Channel Bits Per Sub-Frame		
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	6300 13800
For Sub-Frame 5	Bits	N/A N/A
For Sub-Frame 0	Bits	5460 12960
Max. Throughput averaged over 1 frame	kbps	1952. 3952.
		8 8
UE Category		1-8 1-8

Note 1: 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10MHz channel BW. 3 symbols allocated to PDCCH for 5 MHz and 3 MHz. 4 symbols allocated to PDCCH for 1.4 MHz

Note 2: Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4]

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Note 4: Redundancy version coding sequence is {0, 1, 2, 3} for QPSK.

Table G.3-2 Fixed Reference Channel for Receiver Requirements (TDD)

Parameter	Unit	Value			
Channel Bandwidth	MHz	10			
Allocated resource blocks		50			
Uplink-Downlink Configuration (Note 5)		1			
Allocated subframes per Radio Frame		4+2			
(D+S)					
Number of HARQ Processes	Processes	7			
Maximum number of HARQ transmission		[4]			
Modulation		QPSK			
Target coding rate		1/3			
Information Bit Payload per Sub-Frame	Bits				
For Sub-Frame 4, 9		4392			
For Sub-Frame 1, 6		3240			
For Sub-Frame 5		N/A			
For Sub-Frame 0		4392			
Transport block CRC	Bits	24			
Number of Code Blocks per Sub-Frame					
(Note 5)					
For Sub-Frame 4, 9		1			
For Sub-Frame 1, 6		1			
For Sub-Frame 5		N/A			
For Sub-Frame 0		1			
Binary Channel Bits Per Sub-Frame	Bits				
For Sub-Frame 4, 9		13800			
For Sub-Frame 1, 6		11256			
For Sub-Frame 5		N/A			
For Sub-Frame 0		13104			
Max. Throughput averaged over 1 frame	kbps	1965.			
		6			
UE Category		1-5			

- For normal subframes(0,4,5,9), 2 symbols allocated to PDCCH for 20 MHz, 15 MHz and 10 MHz Note 1: channel BW; 3 symbols allocated to PDCCH for 5 MHz and 3 MHz; 4 symbols allocated to PDCCH for 1.4 MHz. For special subframe (1&6), only 2 OFDM symbols are allocated to PDCCH for all BWs.
- For 1.4MHz, no data shall be scheduled on special subframes(1&6) to avoid problems with Note 2: insufficient PDCCH performance
- Reference signal, Synchronization signals and PBCH allocated as per TS 36.211 [4] Note 3:
- If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to Note 4: each Code Block (otherwise L = 0 Bit). As per Table 4.2-2 in TS 36.211 [4]
- Note 5:
- Redundancy version coding sequence is {0, 1, 2, 3} for QPSK. Note 6:

Annex H (normative): Modified MPR behavior

H.1 Indication of modified MPR behavior

This annex contains the definitions of the bits in the field *modifiedMPRbehavior* indicated in the IE UE Radio Access Capability [7] by a UE supporting an MPR or A-MPR modified in a later release of this specification.

Table H.1-1: Definitions of the bits in the field modifiedMPRbehavior

Index of field	Definition	Notes
(bit number)	(description of the supported functionality if indicator	
	set to one)	
0 (leftmost bit)	- The MPR for intra-band contiguous carrier aggregation bandwidth class C with non-contiguous resource allocation specified in Clause 6.2.3A in version 12.5.0 of this specification	- This bit shall be set to 1 by a UE supporting intra-band contiguous CA bandwidth class C
1	- The A-MPR associated with NS_05 for Band 1 in Clause 6.2.4 in version 12.10.0 of this specification.	- This bit shall be set to 1 by a UE supporting A-MPR associated to NS_05 for Band 1.
2	The A-MPR associated with NS_04 for Band 41 in Table 6.2.4-4 in version 14.1.0 of this specification.	This bit can be set to 1 by a power class 3 UE supporting A-MPR associated to NS_04 for Band 41.

Annex I (informative): Change history

Table I.1: Change History

Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
11-2007	R4#45	R4-72206				TS36.101V0.1.0 approved by RAN4	
12-2007	RP#38	RP-070979				Approved version at TSG RAN #38	8.0.0
03-2008	RP#39	RP-080123	3			TS36.101 - Combined updates of E-UTRA UE requirements	8.1.0
05-2008	RP#40	RP-080325	4			TS36.101 - Combined updates of E-UTRA UE requirements	8.2.0
09-2008	RP#41	RP-080638	5r1			Addition of Ref Sens figures for 1.4MHz and 3MHz Channel bandwiidths	8.3.0
09-2008	RP#41	RP-080638	7r1			Transmitter intermodulation requirements	8.3.0
09-2008	RP#41	RP-080638	10			CR for clarification of additional spurious emission requirement	8.3.0
09-2008	RP#41	RP-080638	15			Correction of In-band Blocking Requirement	8.3.0
09-2008	RP#41	RP-080638	18r1			TS36.101: CR for section 6: NS_06	8.3.0
09-2008	RP#41	RP-080638	19r1			TS36.101: CR for section 6: Tx modulation	8.3.0
09-2008	RP#41	RP-080638	20r1			TS36.101: CR for UE minimum power	8.3.0
09-2008	RP#41	RP-080638	21r1			TS36.101: CR for UE OFF power	8.3.0
09-2008	RP#41	RP-080638	24r1			TS36.101: CR for section 7: Band 13 Rx sensitivity	8.3.0
09-2008	RP#41	RP-080638	26			UE EVM Windowing	8.3.0
09-2008	RP#41	RP-080638	29			Absolute ACLR limit	8.3.0
09-2008	RP#41	RP-080731	23r2			TS36.101: CR for section 6: UE to UE co-existence	8.3.0
09-2008	RP#41	RP-080731	30			Removal of [] for UE Ref Sens figures	8.3.0
09-2008	RP#41	RP-080731	31			Correction of PA, PB definition to align with RAN1 specification	8.3.0
09-2008	RP#41	RP-080731	37r2			UE Spurious emission band UE co-existence	8.3.0
09-2008	RP#41	RP-080731	44			Definition of specified bandwidths	8.3.0
09-2008	RP#41	RP-080731	48r3			Addition of Band 17	8.3.0
09-2008	RP#41	RP-080731	50			Alignment of the UE ACS requirement	8.3.0
09-2008	RP#41	RP-080731	52r1			Frequency range for Band 12	8.3.0
09-2008	RP#41	RP-080731	54r1			Absolute power tolerance for LTE UE power control	8.3.0
09-2008	RP#41	RP-080731	55			TS36.101 section 6: Tx modulation	8.3.0
09-2008	RP#41	RP-080732	6r2			DL FRC definition for UE Receiver tests	8.3.0
09-2008	RP#41	RP-080732	46			Additional UE demodulation test cases	8.3.0
09-2008	RP#41	RP-080732	47			Updated descriptions of FRC	8.3.0
09-2008	RP#41	RP-080732	49			Definition of UE transmission gap	8.3.0
09-2008	RP#41	RP-080732	51			Clarification on High Speed train model in 36.101	8.3.0
09-2008	RP#41	RP-080732	53			Update of symbol and definitions	8.3.0
09-2008	RP#41	RP-080743	56			Addition of MIMO (4x2) and (4x4) Correlation Matrices	8.3.0
12-2008	RP#42	RP-080908	94r2			CR TX RX channel frequency separation	8.4.0
12-2008	RP#42	RP-080909	105r1			UE Maximum output power for Band 13	8.4.0
12-2008	RP#42	RP-080909	60			UL EVM equalizer definition	8.4.0
12-2008	RP#42	RP-080909	63			Correction of UE spurious emissions	8.4.0
12-2008 12-2008	RP#42 RP#42	RP-080909 RP-080909	66 72			Clarification for UE additional spurious emissions Introducing ACLR requirement for coexistance with UTRA	8.4.0 8.4.0
				1		1.6MHZ channel from 36.803	
12-2008	RP#42	RP-080909	75			Removal of [] from Section 6 transmitter characteristics	8.4.0
12-2008 12-2008	RP#42 RP#42	RP-080909 RP-080909	101			Clarification for PHS band protection Alignement for the measurement interval for transmit signal	8.4.0 8.4.0
						quality Novinum payor	8.4.0
12-2008	RP#42	RP-080909	98r1 57r1			Maximum power	8.4.0
12-2008	RP#42	RP-080909	71r1			CR UE spectrum flatness	8.4.0
12-2008 12-2008	RP#42 RP#42	RP-080909 RP-080909	71r1 58r1			UE in-band emission CR Number of TX exceptions	8.4.0
12-2008	RP#42 RP#42	RP-080909	99r2			CR UE output power dynamic	8.4.0
12-2008	RP#42	RP-080951	79r1			LTE UE transmitter intermodulation	8.4.0
12-2008	RP#42	RP-080931	91			Update of Clause 8	8.4.0
12-2008	RP#42	RP-080910	106r1			Structure of Clause 9 including CSI requirements for PUCCH	8.4.0
						mode 1-0	
12-2008	RP#42	RP-080911	59 65			CR UE ACS test frequency offset	8.4.0 8.4.0
12-2008	RP#42	RP-080911	65	1	ı	Correction of spurious response parameters	0.4.0

12-2008	RP#42	RP-080911	80	Removal of LTE UE narrowband intermodulation	8.4.0
12-2008	RP#42	RP-080911	90r1	Introduction of Maximum Sensitivity Degradation	8.4.0
12-2008	RP#42	RP-080911	103	Removal of [] from Section 7 Receiver characteristic	8.4.0
12-2008	RP#42	RP-080912	62	Alignement of TB size n Ref Meas channel for RX characteristics	8.4.0
12-2008	RP#42	RP-080912	78	TDD Reference Measurement channel for RX characterisctics	8.4.0
12-2008	RP#42	RP-080912	73r1	Addition of 64QAM DL referenbce measurement channel	8.4.0
12-2008	RP#42	RP-080912	74r1	Addition of UL Reference Measurement Channels	8.4.0
12-2008	RP#42	RP-080912	104	Reference measurement channels for PDSCH performance requirements (TDD)	8.4.0
12-2008	RP#42	RP-080913	68	MIMO Correlation Matrix Corrections	8.4.0
12-2008	RP#42	RP-080915	67	Correction to the figure with the Transmission Bandwidth configuration	8.4.0
12-2008	RP#42	RP-080916	77	Modification to EARFCN	8.4.0
12-2008	RP#42	RP-080917	85r1	New Clause 5 outline	8.4.0
12-2008	RP#42	RP-080919	102	Introduction of Bands 12 and 17 in 36.101	8.4.0
12-2008	RP#42	RP-080927	84r1	Clarification of HST propagation conditions	8.4.0
03-2009	RP#43	RP-090170	156r2	A-MPR table for NS_07	8.5.0
03-2009	RP#43	RP-090170	170	Corrections of references (References to tables and figures)	8.5.0
03-2009	RP#43	RP-090170	108	Removal of [] from Transmitter Intermodulation	8.5.0
03-2009	RP#43	RP-090170	155	E-UTRA ACLR for below 5 MHz bandwidths	8.5.0
03-2009	RP#43	RP-090170	116	Clarification of PHS band including the future plan	8.5.0
03-2009	RP#43	RP-090170	119	Spectrum emission mask for 1.4 MHz and 3 MHz bandwidhts	8.5.0
03-2009	RP#43	RP-090170	120	Removal of "Out-of-synchronization handling of output power" heading	8.5.0
03-2009	RP#43	RP-090170	126	UE uplink power control	8.5.0
03-2009	RP#43	RP-090170	128	Transmission BW Configuration	8.5.0
03-2009	RP#43	RP-090170	130	Spectrum flatness	8.5.0
03-2009	RP#43	RP-090170	132r2	PUCCH EVM	8.5.0
03-2009	RP#43	RP-090170	134	UL DM-RS EVM	8.5.0
03-2009	RP#43	RP-090170	140	Removal of ACLR2bis requirements	8.5.0
03-2009	RP#43	RP-090171	113	In-band blocking	8.5.0
03-2009	RP#43	RP-090171	127	In-band blocking and sensitivity requirement for band 17	8.5.0
03-2009	RP#43	RP-090171	137r1	Wide band intermodulation	8.5.0
03-2009	RP#43	RP-090171	141	Correction of reference sensitivity power level of Band 9	8.5.0
03-2009	RP#43	RP-090172	109	AWGN level for UE DL demodulation performance tests	8.5.0
03-2009	RP#43	RP-090172	124	Update of Clause 8: additional test cases	8.5.0
03-2009	RP#43	RP-090172	139r1	Performance requirement structure for TDD PDSCH	8.5.0
03-2009	RP#43	RP-090172	142r1	Performance requirements and reference measurement channels for TDD PDSCH demodulation with UE-specific reference symbols	8.5.0
03-2009	RP#43	RP-090172	145	Number of information bits in DwPTS	8.5.0
03-2009	RP#43	RP-090172	160r1	MBSFN-Unicast demodulation test case	8.5.0
03-2009	RP#43	RP-090172	163r1	MBSFN-Unicast demodulation test case for TDD	8.5.0
03-2009	RP#43	RP-090173	162	Clarification of EARFCN for 36.101	8.5.0
03-2009	RP#43	RP-090369	110	Correction to UL Reference Measurement Channel	8.5.0
03-2009	RP#43	RP-090369	114	Addition of MIMO (4x4, medium) Correlation Matrix	8.5.0
03-2009	RP#43	RP-090369	121	Correction of 36.101 DL RMC table notes	8.5.0
03-2009	RP#43	RP-090369	125	Update of Clause 9	8.5.0
03-2009	RP#43	RP-090369	138r1	Clarification on OCNG	8.5.0
03-2009	RP#43	RP-090369	161	CQI reference measurement channels	8.5.0
03-2009	RP#43	RP-090369	164	PUCCH 1-1 Static Test Case	8.5.0
03-2009	RP#43	RP-090369	111	Reference Measurement Channel for TDD	8.5.0
03-2009	RP#44			Editorial correction in Table 6.2.4-1	8.5.1
05-2009	RP#44	RP-090540	167	Boundary between E-UTRA fOOB and spurious emission domain for 1.4 MHz and 3 MHz bandwiths. (Technically	8.6.0
05 2000	DD#44	DD 000540	160	Endorsed CR in R4-50bis - R4-091205) EARFCN correction for TDD DL bands. (Technically Endorsed	8.6.0
05-2009	RP#44	RP-090540	168	EARTON CORRECTION for TOD DL bands. (Technically Endorsed	0.0.0

				CR in R4-50bis - R4-091206) Editorial correction to in-band blocking table. (Technically	
05-2009	RP#44	RP-090540	169	Endorsed CR in R4-50bis - R4-091238)	8.6.0
05-2009	RP#44	RP-090540	171	CR PRACH EVM. (Technically Endorsed CR in R4-50bis - R4-091308)	8.6.0
05-2009	RP#44	RP-090540	172	CR EVM correction. (Technically Endorsed CR in R4-50bis - R4-091309)	8.6.0
05-2009	RP#44	RP-090540	177	CR power control accuracy. (Technically Endorsed CR in R4-50bis - R4-091418)	8.6.0
05-2009	RP#44	RP-090540	179	Correction of SRS requirements. (Technically Endorsed CR in R4-50bis - R4-091426)	8.6.0
05-2009	RP#44	RP-090540	186	Clarification for EVM. (Technically Endorsed CR in R4-50bis - R4-091512)	8.6.0
05-2009	RP#44	RP-090540	187	Removal of [] from band 17 Refsens values and ACS offset frequencies	8.6.0
05-2009	RP#44	RP-090540	191	Completion of band17 requirements	8.6.0
05-2009	RP#44	RP-090540	192	Removal of 1.4 MHz and 3 MHz bandwidths from bands 13, 14 and 17.	8.6.0
05-2009	RP#44	RP-090540	223	CR: 64 QAM EVM	8.6.0
05-2009	RP#44	RP-090540	201	CR In-band emissions	8.6.0
05-2009	RP#44	RP-090540	203	CR EVM exclusion period	8.6.0
05-2009	RP#44	RP-090540	204	CR In-band emissions timing	8.6.0
05-2009	RP#44	RP-090540	206	CR Minimum Rx exceptions	8.6.0
05-2009	RP#44	RP-090540	207	CR UL DM-RS EVM	8.6.0
05-2009	RP#44	RP-090540	218r1	A-MPR table for NS_07	8.6.0
05-2009	RP#44	RP-090540	205r1	CR In-band emissions in shortened subframes	8.6.0
05-2009	RP#44	RP-090540	200r1	CR PUCCH EVM	8.6.0
05-2009	RP#44	RP-090540	178r2	No additional emission mask indication. (Technically Endorsed CR in R4-50bis - R4-091421)	8.6.0
05-2009	RP#44	RP-090540	220r1	Spectrum emission requirements for band 13	8.6.0
05-2009	RP#44	RP-090540	197r2	CR on aggregate power tolerance	8.6.0
05-2009	RP#44	RP-090540	196r2	CR: Rx IP2 performance	8.6.0
05-2009	RP#44	RP-090541	198r1	Maximum output power relaxation	8.6.0
05-2009	RP#44	RP-090542	166	Update of performance requirement for TDD PDSCH with MBSFN configuration. (Technically Endorsed CR in R4-50bis - R4-091180)	8.6.0
05-2009	RP#44	RP-090542	175	Adding AWGN levels for some TDD DL performance requirements. (Technically Endorsed CR in R4-50bis - R4-091406)	8.6.0
05-2009	RP#44	RP-090542	182	OCNG Patterns for Single Resource Block FRC Requirements. (Technically Endorsed CR in R4-50bis - R4- 091504)	8.6.0
05-2009	RP#44	RP-090542	170r1	Update of Clause 8: PHICH and PMI delay. (Technically Endorsed CR in R4-50bis - R4-091275)	8.6.0
05-2009	RP#44	RP-090543	183	Requirements for frequency-selective fading test. (Technically Endorsed CR in R4-50bis - R4-091505)	8.6.0
05-2009	RP#44	RP-090543	199	CQI requirements under AWGN conditions	8.6.0
05-2009	RP#44	RP-090543	188r1	Adaptation of UL-RMC-s for supporting more UE categories	8.6.0
05-2009	RP#44	RP-090543	193r1	Correction of the LTE UE downlink reference measurement channels	8.6.0
05-2009	RP#44	RP-090543	184r1	Requirements for frequency non-selective fading tests. (Technically Endorsed CR in R4-50bis - R4-091506)	8.6.0
05-2009	RP#44	RP-090543	185r1	Requirements for PMI reporting. (Technically Endorsed CR in R4-50bis - R4-091510)	8.6.0
05-2009	RP#44	RP-090543	221r1	Correction to DL RMC-s for Maximum input level for supporting more UE-Categories	8.6.0
05-2009	RP#44	RP-090543	216	Addition of 15 MHz and 20 MHz bandwidths into band 38	8.6.0
05-2009	RP#44	RP-090559	180	Introduction of Extended LTE800 requirements. (Technically Endorsed CR in R4-50bis - R4-091432)	9.0.0
09-2009	RP#45	RP-090826	239	A-MPR for Band 19	9.1.0
09-2009	RP#45	RP-090822	225	LTE UTRA ACLR1 centre frequency definition for 1.4 and 3 MHz BW	9.1.0
09-2009	RP#45	RP-090822	227	Harmonization of text for LTE Carrier leakage	9.1.0
09-2009	RP#45	RP-090822	229	Sensitivity requirements for Band 38 15 MHz and 20 MHz bandwidths	9.1.0
09-2009	RP#45	RP-090822	236	Operating band edge relaxation of maximum output power for Band 18 and 19	9.1.0
09-2009	RP#45	RP-090822	238	Addition of 5MHz channel bandwidth for Band 40	9.1.0
09-2009	RP#45	RP-090822	245	Removal of unnecessary requirements for 1.4 and 3 MHz bandwidths on bands 13 and 17	9.1.0
09-2009	RP#45	RP-090877	261	Correction of LTE UE ACS test parameter	9.1.0
09-2009	RP#45	RP-090877	263R1	Correction of LTE UE ACLR test parameter	9.1.0

09-2009	RP#45	RP-090877	286	Uplink power and RB allocation for receiver tests	9.1.0
09-2009	RP#45	RP-090877	320	CR Sensitivity relaxation for small BW	9.1.0
09-2009	RP#45	RP-090877	324	Correction of Band 3 spurious emission band UE co-existence	9.1.0
09-2009	RP#45	RP-090877	249R1	CR Pcmax definition (working assumption)	9.1.0
09-2009	RP#45	RP-090877	330	Spectrum flatness clarification	9.1.0
09-2009	RP#45	RP-090877	332	Transmit power: removal of TC and modification of REFSENS note	9.1.0
09-2009	RP#45	RP-090877	282R1	Additional SRS relative power requirement and update of measurement definition	9.1.0
09-2009	RP#45	RP-090877	284R1	Power range applicable for relative tolerance	9.1.0
09-2009	RP#45	RP-090878	233	TDD UL/DL configurations for CQI reporting	9.1.0
09-2009	RP#45	RP-090878	235	Further clarification on CQI test configurations	9.1.0
09-2009	RP#45	RP-090878	243	Corrections to UL- and DL-RMC-s	9.1.0
09-2009	RP#45	RP-090878	247	Reference measurement channel for multiple PMI requirements	9.1.0
09-2009	RP#45	RP-090878	290	CQI reporting test for a scenario with frequency-selective interference	9.1.0
09-2009	RP#45	RP-090878	265R2	CQI reference measurement channels	9.1.0
09-2009	RP#45	RP-090878	321R1	CR RI Test	9.1.0
09-2009	RP#45	RP-090875	231	Correction of parameters for demodulation performance requirement	9.1.0
09-2009	RP#45	RP-090875	241R1	UE categories for performance tests and correction to RMC references	9.1.0
09-2009	RP#45	RP-090875	333	Clarification of Ês definition in the demodulation requirement	9.1.0
09-2009	RP#45	RP-090875	326	Editorial corrections and updates to PHICH PBCH test cases.	9.1.0
09-2009	RP#45	RP-090875	259R3	Test case numbering in section 8 Performance tests	9.1.0
12-2009	RP-46	RP-091264	335	Test case numbering in TDD PDSCH performance test (Technically endorsed at RAN 4 52bis in R4-093523)	9.2.0
12-2009	RP-46	RP-091261	337	Adding beamforming model for user-specfic reference signal (Technically endorsed at RAN 4 52bis in R4-093525)	9.2.0
12-2009	RP-46	RP-091263	339R1	Adding redundancy sequences to PMI test (Technically endorsed at RAN 4 52bis in R4-093581)	9.2.0
12-2009	RP-46	RP-091264	341	Throughput value correction at FRC for Maximum input level (Technically endorsed at RAN 4 52bis in R4-093660)	9.2.0
12-2009	RP-46	RP-091261	343	Correction to the modulated E-UTRA interferer (Technically endorsed at RAN 4 52bis in R4-093662)	9.2.0
12-2009	RP-46	RP-091264	345R1	OCNG: Patterns and present use in tests (Technically endorsed at RAN 4 52bis in R4-093664)	9.2.0
12-2009	RP-46	RP-091264	347	OCNG: Use in receiver and performance tests (Technically endorsed at RAN 4 52bis in R4-093666)	9.2.0
12-2009	RP-46	RP-091263	349	Miscellaneous corrections on CSI requirements (Technically endorsed at RAN 4 52bis in R4-093676)	9.2.0
12-2009	RP-46	RP-091261	351	Removal of RLC modes (Technically endorsed at RAN 4 52bis in R4-093677)	9.2.0
12-2009	RP-46	RP-091261	353	CR Rx diversity requirement (Technically endorsed at RAN 4 52bis in R4-093703)	9.2.0
12-2009	RP-46	RP-091261	355	A-MPR notation in NS_07 (Technically endorsed at RAN 4 52bis in R4-093706) Single- and multi-PMI requirements (Technically endorsed at	9.2.0
12-2009	RP-46	RP-091263	359	RAN 4 52bis in R4-093846) CQI reference measurement channel (Technically endorsed at	9.2.0
12-2009	RP-46	RP-091263	363	RAN 4 52bis in R4-093970) LTE MBSFN Channel Model (Technically endorsed at RAN 4	9.2.0
12-2009	RP-46	RP-091292	364	52bis in R4-094020) Numbering of PDSCH (User-Specific Reference Symbols)	9.2.0
12-2009	RP-46	RP-091264	367	Demodulation Tests	9.2.0
12-2009	RP-46	RP-091264	369	Numbering of PDCCH/PCFICH, PHICH, PBCH Demod Tests	9.2.0
12-2009	RP-46	RP-091261	371	Remove [] from Reference Measurement Channels in Annex A	9.2.0
12-2009	RP-46	RP-091264	373R1	Corrections to RMC-s for Maximum input level test for low UE categories	9.2.0
12-2009	RP-46	RP-091261	377	Correction of UE-category for R.30	9.2.0
12-2009	RP-46 RP-46	RP-091286 RP-091262	378	Introduction of Extended LTE1500 requirements for TS36.101 CR: Removal of 1.4 MHz and 3 MHz channel bandwidths from additional spurious emissions requirements for Band 1 PHS protection	9.2.0
12-2009	RP-46	RP-091262	386R3	Clarification of measurement conditions of spurious emission requirements at the edge of spurious domain	9.2.0
12-2009	RP-46	RP-091262	390	Spurious emission table correction for TDD bands 33 and 38.	9.2.0
12-2009	RP-46	RP-091262	392R2	36.101 Symbols and abreviations for Pcmax	9.2.0
12-2009	RP-46	RP-091262	394	UTRAACLR1 requirement definition for 1.4 and 3 MHz BW completed	9.2.0
12-2009	RP-46	RP-091263	396	Introduction of the ACK/NACK feedback modes for TDD	9.2.0

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12-2009	RP-46	RP-091262	404R3	CR Power control exception R8	9.2.0
12-2009	RP-46	RP-091262	416R1	Relative power tolerance: special case for receiver tests	9.2.0
12-2009	RP-46	RP-091263	420R1	CSI reporting: test configuration for CQI fading requirements	9.2.0
12-2009	RP-46	RP-091284	421R1	Inclusion of Band 20 UE RF parameters	9.2.0
12-2009	RP-46	RP-091264	425	Editorial corrections and updates to Clause 8.2.1 FDD	9.2.0
12-2009	RP-46	RP-091262	427	demodulation test cases CR: time mask	9.2.0
12-2009	RP-46	RP-091264	430	Correction of the payload size for PDCCH/PCFICH	9.2.0
12-2009	RP-46	RP-091263	432	performance requirements Transport format and test point updates to RI reporting test cases	9.2.0
12-2009	RP-46	RP-091263	434	Transport format and test setup updates to frequency-	9.2.0
12-2009	RP-46	RP-091263	436	selective interference CQI tests CR RI reporting configuration in PUCCH 1-1 test	9.2.0
12-2009	RP-46	RP-091261	438	Addition of R.11-1 TDD references	9.2.0
12-2009	RP-46	RP-091292	439	Performance requirements for LTE MBMS	9.2.0
12-2009	RP-46	RP-091262	442R1	In Band Emissions Requirements Correction CR	9.2.0
12-2009	RP-46	RP-091262	444R1	PCMAX definition	9.2.0
03-2010	RP-47	RP-100246	453r1	Corrections of various errors in the UE RF requirements	9.3.0
03-2010	RP-47	RP-100246	462r1	UTRA ACLR measurement bandwidths for 1.4 and 3 MHz	9.3.0
03-2010	RP-47	RP-100246	493	Band 8 Coexistence Requirement Table Correction	9.3.0
03-2010	RP-47	RP-100246	489r1	Rel 9 CR for Band 14	9.3.0
03-2010	RP-47	RP-100246	485r1	CR Band 1- PHS coexistence	9.3.0
03-2010	RP-47	RP-100247	501	Fading CQI requirements for FDD mode	9.3.0
03-2010	RP-47	RP-100247	499	CR correction to RI test	9.3.0
03-2010	RP-47	RP-100249	451	Reporting mode, Reporting Interval and Editorial corrections for demodulation	9.3.0
03-2010	RP-47	RP-100249	464r1	Corrections to 1PRB PDSCH performance test in presence of MBSFN.	9.3.0
03-2010	RP-47	RP-100249	458r1	OCNG corrections	9.3.0
03-2010	RP-47	RP-100249	467	Addition of ONCG configuration in DRS performance test	9.3.0
03-2010	RP-47	RP-100249	465r1	PDSCH performance tests for low UE categories	9.3.0
03-2010	RP-47	RP-100249	460r1		9.3.0
				Use of OCNG in CSI tests	
03-2010	RP-47	RP-100250	491r1	Corrections to CQI test configurations	9.3.0
03-2010	RP-47	RP-100250	469r1	Corrections of some CSI test parameters	9.3.0
03-2010	RP-47	RP-100251	456r1	TBS correction for RMC UL TDD 16QAM full allocation BW 1.4 MHz	9.3.0
03-2010	RP-47	RP-100262	449	Editorial corrections on Band 19 REFSENS	9.3.0
03-2010	RP-47	RP-100263	470r1	Band 20 UE RF requirements	9.3.0
03-2010	RP-47	RP-100264	446r1	A-MPR for Band 21	9.3.0
03-2010	RP-47	RP-100264	448	RF requirements for UE in later releases	9.3.0
03-2010	RP-47	RP-100268	445	36.101 CR: Editorial corrections on LTE MBMS reference measurement channels	9.3.0
03-2010	RP-47	RP-100268	454	The definition of the Doppler shift for LTE MBSFN Channel Model	9.3.0
03-2010	RP-47	RP-100239	478r3	Modification of the spectral flatness requirement and some editorial corrections	9.3.0
06-2010	RP-48	RP-100619	559	Corrections of tables for Additional Spectrum Emission Mask	9.4.0
06-2010	RP-48	RP-100619	538	Correction of transient time definition for EVM requirements	9.4.0
06-2010	RP-48	RP-100619	557r2	CR on UE coexistence requirement	9.4.0
06-2010	RP-48	RP-100619	547r1	Correction of antenna configuration and beam-forming model for DRS	9.4.0
06-2010	RP-48	RP-100619	536r1	CR: Corrections on MIMO demodulation performance requirements	9.4.0
06-2010	RP-48	RP-100619	528r1	Corrections on the definition of PCMAX	9.4.0
06-2010	RP-48	RP-100619	568	Relaxation of the PDSCH demodulation requirements due to control channel errors	9.4.0
06-2010	RP-48	RP-100619	566	Correction of the UE output power definition for RX tests	9.4.0
06-2010	RP-48	RP-100620	505r1	Fading CQI requirements for TDD mode	9.4.0
06-2010	RP-48	RP-100620	521	Correction to FRC for CQI index 0	9.4.0
06-2010	RP-48	RP-100620	516r1	Correction to CQI test configuration	9.4.0
06-2010	RP-48	RP-100620	532	Correction of CQI and PMI delay configuration description for TDD	9.4.0
06-2010	RP-48	RP-100620	574	Correction to FDD and TDD CSI test configurations	9.4.0
06-2010	RP-48	RP-100620	571	Minimum requirements for Rank indicator reporting	9.4.0
	RP-48	RP-100628	563	LTE MBMS performance requirements (FDD)	9.4.0
06-2010			564	LTE MBMS performance requirements (TDD)	9.4.0
06-2010 06-2010		1 RP-100628			
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06-2010 06-2010	RP-48 RP-48	RP-100629	553r2	Performance requirements for dual-layer beamforming CR: low Category CSI requirement	9.4.0
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06-2010				Specification of minimum performance requirements for low	
00 2010	RP-48	RP-100630	539	UE category	9.4.0
06-2010				Addition of minimum performance requirements for low UE	0.40
	RP-48	RP-100630	569	category TDD CRS single-antenna port tests	9.4.0
06-2010				Introduction of sustained downlink data-rate performance	9.4.0
	RP-48	RP-100631	549r3	requirements	9.4.0
06-2010	RP-48	RP-100683	530r1	Band 20 Rx requirements	9.4.0
09-2010	RP-49	RP-100920	614r2	Add OCNG to MBMS requirements	9.5.0
09-2010	RP-49	RP-100916	599	Correction of PDCCH content for PHICH test	9.5.0
09-2010	RP-49	RP-100920	597r1	Beamforming model for transmission on antenna port 7/8	9.5.0
09-2010	RP-49	RP-100920	600r1	Correction of full correlation in frequency-selective CQI test	9.5.0
09-2010				Correction on single-antenna transmission fixed reference	
00 2010	RP-49	RP-100920	601	channel	9.5.0
09-2010	55.46	DD 100011		Reference sensitivity requirements for the 1.4 and 3 MHz	
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09-2010	RP-49	RP-100920	608r1	CR for DL sustained data rate test	9.5.0
09-2010	DD 40	DD 400040		Correction of references in section 10 (MBMS performance	0.50
00.0040	RP-49	RP-100919	611	requirements)	9.5.0
09-2010	RP-49	RP-100914	613	Band 13 and Band 14 spurious emission corrections	9.5.0
09-2010	RP-49	RP-100919	617r1	Rx Requirements	9.5.0
09-2010	RP-49	RP-100926	576r1	Clarification on DL-BF simulation assumptions	9.5.0
09-2010	RP-49	RP-100920	582r1	Introduction of additional Rel-9 scenarios	9.5.0
09-2010	RP-49 RP-49	RP-100925	575r1	Correction to band 20 ue to ue Co-existence table	9.5.0
09-2010 09-2010	RP-49 RP-49	RP-100916 RP-100916	581r1	Test configuration corrections to CQI reporting in AWGN Corrections to RF OCNG Pattern OP.1 and 2	9.5.0
			595		9.5.0
09-2010	RP-49	RP-100919	583	Editorial corrections of 36.101	9.5.0
09-2010	RP-49	RP-100920	586	Addition of minimum performance requirements for low UE category TDD tests	9.5.0
09-2010	RP-49	RP-100920	590r1	Downlink power for receiver tests	9.5.0
09-2010	RP-49	RP-100914	591	OCNG use and power in beamforming tests	9.5.0
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09-2010	RP-49	RP-100914	588	Missing note in Additional spurious emission test with NS_07	9.5.0
09-2010	RP-49	RP-100914	596r2	CR LTE_TDD_2600_US spectrum band definition additions to	10.0.0
09-2010	101 -43	100327	33012	TS 36.101	10.0.0
12-2010	RP-50	RP-101309	680	Demodulation performance requirements for dual-layer	10.1.0
12 2010	10.30	101303	000	beamforming	10.1.0
12-2010	RP-50	RP-101325	672	Correction on the statement of TB size and subband selection	10.1.0
12 2010	1 00	111 101020	0.2	in CSI tests	10.1.0
12-2010	RP-50	RP-101327	652	Correction to Band 12 frequency range	10.1.0
12-2010	RP-50	RP-101329	630	Removal of [] from TDD Rank Indicator requirements	10.1.0
12-2010	RP-50	RP-101329	635r1	Test configuration corrections to CQI TDD reporting in AWGN	10.1.0
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12-2010	RP-50	RP-101330	645	EVM window length for PRACH	10.1.0
12-2010	RP-50	RP-101330	649	Removal of NS signalling from TDD REFSENS tests	10.1.0
12-2010	RP-50	RP-101330	642r1	Correction of Note 4 In Table 7.3.1-1: Reference sensitivity	10.1.0
				QPSK PREFSENS	
12-2010	RP-50	RP-101341	627	Add 20 RB UL Ref Meas channel	10.1.0
12-2010	RP-50	RP-101341	654r1	Additional in-band blocking requirement for Band 12	10.1.0
12-2010	RP-50	RP-101341	678	Further clarifications for the Sustained Downlink Data Rate	10.1.0
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12-2010	RP-50	RP-101341	673r1	Correction on MBMS performance requirements	10.1.0
12-2010	RP-50	RP-101349	667r3	CR Removing brackets of Band 41 reference sensitivity to TS	10.1.0
40.0075	DD 50	DD 404055	000.0	36.101	40.4.5
12-2010	RP-50	RP-101356	666r2	Band 42 and 43 parameters for UMTS/LTE 3500 (TDD) for TS	10.1.0
10.0040	DD 50	DD 404050	640-4	36.101 CR for CA, UL-MIMO, eDL-MIMO, CPE	10.4.0
12-2010	RP-50	RP-101359	646r1		10.1.0
12-2010 12-2010	RP-50 RP-50	RP-101361 RP-101379	620r1	Introduction of L-band in TS 36.101 Correction on the PMI reporting in Multi-Laye Spatial	10.1.0
12-2010	VC-20	KP-1013/9	670r1	Multiplexing performance test	10.1.0
12-2010	RP-50	RP-101380	679r1	Adding antenna configuration in CQI fading test case	10.1.0
01-2011	111 -00	131 - 10 1300	01311	Clause numbering correction	10.1.0
03-2011	RP-51	RP-110359	695	Removal of E-UTRA ACLR for CA	10.1.1
03-2011	RP-51	RP-110338	699	PDCCH and PHICH performance: OCNG and power settings	10.2.0
03-2011	RP-51	RP-110336	706r1	Spurious emissions measurement uncertainty	10.2.0
03-2011	RP-51	RP-110350	70011 707r1	REFSENSE in lower SNR	10.2.0
03-2011	RP-51	RP-110338	710	PMI performance: Power settings and precoding granularity	10.2.0
03-2011	RP-51	RP-110359	715r2	Definition of configured transmitted power for Rel-10	10.2.0
03-2011	RP-51	RP-110359	717	Introduction of requirement for adjacent intraband CA image	10.2.0
00 2011	111 -01	131 - 110009	' '	rejection	10.2.0
03-2011	RP-51	RP-110343	719	Minimum requirements for the additional Rel-9 scenarios	10.2.0
03-2011	RP-51	RP-110343	723	Corrections to power settings for Single layer beamforming	10.2.0
	" " "	1		with simultaneous transmission	

03-2011	RP-51	RP-110338	730	Removing the square bracket for TS36.101	10.2.0
03-2011	RP-51	RP-110349	739	Removal of square brackets for dual-layer beamforming	10.2.0
00 2011	14. 01	111 110010	1.00	demodulation performance requirements	10.2.0
03-2011	RP-51	RP-110359	751	CR: Maximum input level for intra band CA	10.2.0
03-2011	RP-51	RP-110349	754r2	UE category coverage for dual-layer beamforming	10.2.0
03-2011	RP-51	RP-110343	756r1	Further clarifications for the Sustained Downlink Data Rate Test	10.2.0
03-2011	RP-51	RP-110343	759	Removal of square brackets in sustained data rate tests	10.2.0
03-2011	RP-51	RP-110337	762r1	Clarification to LTE relative power tolerance table	10.2.0
03-2011	RP-51	RP-110343	764	Introducing UE-selected subband CQI tests	10.2.0
03-2011	RP-51	RP-110343	765	Verification framework for PUSCH 2-2 and PUCCH 2-1 reporting	10.2.0
04-2011				Editorial: Spec Title correction, removal of "Draft"	10.2.1
06-2011	RP-52	RP-110804	766	Add Expanded 1900MHz Band (Band 25) in 36.101	10.3.0
06-2011	RP-52	RP-110795	768	Fixing Band 24 inclusion in TS 36.101	10.3.0
06-2011	RP-52	RP-110788	772	CR: Corrections for UE to UE co-existence requirements of Band 3	10.3.0
06-2011	RP-52	RP-110812	774	Add 2GHz S-Band (Band 23) in 36.101	10.3.0
06-2011 06-2011	RP-52 RP-52	RP-110789 RP-110796	782 787	CR: Band 19 A-MPR refinement REFSENS in lower SNR	10.3.0
06-2011	RP-52	RP-110796	805	Clarification for MBMS reference signal levels	10.3.0 10.3.0
06-2011	RP-52	RP-110799	810	FDD MBMS performance requirements for 64QAM mode	10.3.0
06-2011	RP-52	RP-110792	814	Correction on CQI mapping index of RI test	10.3.0
06-2011	RP-52	RP-110789	824	Corrections to in-band blocking table	10.3.0
06-2011	RP-52	RP-110794	826	Corrections to In-barra blocking table Correction of TDD Category 1 DRS and DMRS RMCs	10.3.0
06-2011	RP-52	RP-110794	828	TDD MBMS performance requirements for 64QAM mode	10.3.0
06-2011	RP-52	RP-110796	829	Correction of TDD RMC for Low SNR Demodulation test	10.3.0
06-2011	RP-52	RP-110796	830	Informative reference sensitivity requirements for Low SNR for TDD	10.3.0
06-2011	RP-52	RP-110787	778r1	Minor corrections to DL-RMC-s for Maximum input level	10.3.0
06-2011	RP-52	RP-110789	832	PDCCH and PHICH performance: OCNG and power settings	10.3.0
06-2011	RP-52	RP-110789	818r1	Correction on 2-X PMI test for R10	10.3.0
06-2011	RP-52	RP-110791	816r1	Addition of performance requirements for dual-layer beamforming category 1 UE test	10.3.0
06-2011	RP-52	RP-110789	834	Performance requirements for PUCCH 2-0, PUCCH 2-1 and PUSCH 2-2 tests	10.3.0
06-2011	RP-52	RP-110807	835r1	CR for UL MIMO and CA	10.3.0
09-2011	RP-53	RP-111248	862r1	Removal of unnecessary channel bandwidths from REFSENS tables	10.4.0
09-2011	RP-53	RP-111248	869r1	Clarification on BS precoding information field for RI FDD and PUCCH 2-1 PMI tests	10.4.0
09-2011	RP-53	RP-111248	872r1	CR for B14Rx requirement Rrel 10	10.4.0
09-2011	RP-53	RP-111248	890r1	CR to TS36.101: Correction on the accuracy test of CQI.	10.4.0
09-2011	RP-53	RP-111248	893	CR to TS36.101: Correction on CQI mapping index of TDD RI test	10.4.0
09-2011	RP-53	RP-111248	904	Correction of code block numbers for some RMCs	10.4.0
09-2011 09-2011	RP-53 RP-53	RP-111248 RP-111248	907 914r1	Correction to UL RMC for FDD and TDD Adding codebook subset restriction for single layer closed-loop	10.4.0 10.4.0
09-2011	RP-53	RP-111251	883	spatial multiplexing test Sustained data rate: Correction of the ACK/NACK feedback	10.4.0
00.0011	DD 50	DD 444054	000	mode	40.40
09-2011 09-2011	RP-53 RP-53	RP-111251 RP-111251	929 938	36.101 CR on MBSFN FDD requirements(R10) TDD MBMS performance requirements for 64QAM mode	10.4.0 10.4.0
09-2011	RP-53	RP-111251	895	Further clarification for the dual-layer beamforming	10.4.0
09-2011	RP-53	RP-111255	908r1	demodulation requirements Introduction of Band 22	10.4.0
09-2011	RP-53	RP-111255	939	Modifications of Band 42 and 43	10.4.0
09-2011	RP-53	RP-111260	939	CR for TS 36.101 Annex B: Static channels for CQI tests	10.4.0
09-2011	RP-53	RP-111262	878r1	Correction of CSI reference channel subframe description	10.4.0
09-2011	RP-53	RP-111262	887	Correction to UL MIMO	10.4.0
09-2011	RP-53	RP-111262	926r1	Power control accuracy for intra-band carrier aggregation	10.4.0
09-2011	RP-53	RP-111262	927r1	In-band emissions requirements for intra-band carrier aggregation	10.4.0
09-2011	RP-53	RP-111262	930r1	Adding the operating band for UL-MIMO	10.4.0
09-2011	RP-53	RP-111265	848	Corrections to intra-band contiguous CA RX requirements	10.4.0
09-2011	RP-53	RP-111265	863	Intra-band contiguos CA MPR requirement refinement	10.4.0
09-2011	RP-53	RP-111265	866r1	Intra-band contiguous CA EVM	10.4.0
09-2011	RP-53	RP-111266	935	Introduction of the downlink CA demodulation requirements	10.4.0
09-2011	RP-53	RP-111266	936r1	Introduction of CA UE demodulation requirements for TDD	10.4.0
12-2011	RP-54	RP-111684	947	Corrections of UE categories of Rel-10 reference channels for RF requirements	10.5.0
12-2011	RP-54	RP-111684	948	Alternative way to define channel bandwidths per operating band for	10.5.0
12-2011	RP-54	RP-111686	949	CR for TS36.101: Adding note to the function of MPR	10.5.0

12-2011	RP-54	RP-111680	950	Clarification on applying CSI reports during rank switching in RI FDD test - Rel-10	10.5.0
12-2011	RP-54	RP-111734	953r1	Corrections for Band 42 and 43 introduction	10.5.0
12-2011	RP-54	RP-111680	956	UE spurious emissions	10.5.0
12-2011	RP-54	RP-111682	959	Add scrambling identity n_SCID for MU-MIMO test	10.5.0
12-2011	RP-54	RP-111690	960r1	P-MPR definition	10.5.0
12-2011	RP-54	RP-111693	962	Pcmax,c Computation Assumptions	10.5.0
12-2011	RP-54			Correction of frequency range for spurious emission	10.5.0
	1 0.	RP-111733	963r1	requirements	
12-2011	RP-54	RP-111680	966	General review of the reference measurement channels	10.5.0
12-2011	RP-54	RP-111691	945	Corrections of Rel-10 demodulation performance requirements	10.5.0
12 2011		141 111001	0.10	This CR is only partially implemented due to confliction with CR 966	10.0.0
12-2011	RP-54	RP-111684	946	Corrections of UE categories for Rel-10 CSI requirements This CR is only partially implemented due to confliction with CR 966	10.5.0
12-2011	RP-54	RP-111691	982r2	Introduction of SDR TDD test scenario for CA UE demodulation This CR is only partially implemented due to confliction with CR 966	10.5.0
12-2011	RP-54	RP-111693	971r1	CR on Colliding CRS for non-MBSFN ABS	10.5.0
12-2011	RP-54	141 -111093	J/ 11 1	Introduction of eICIC demodulation performance requirements	10.5.0
		RP-111693	972r1	for FDD and TDD Adding missing UL configuration specification in some UE	
12-2011	RP-54	DD 111606	OOF		10.5.0
10.0044	DD 54	RP-111686	985	receiver requirements for case of 1 CC UL capable UE	10.5.0
12-2011	RP-54	DD 444004	000	Correction and maintenance on CQI and PMI requirements	10.5.0
40.0041	DD 5 :	RP-111684	998	(Rel-10)	40.50
12-2011	RP-54	RP-111735	1004	MPR for CA Multi-cluster	10.5.0
12-2011	RP-54	RP-111691	1005	CA demodulation performance requirements for LTE FDD	10.5.0
12-2011	RP-54	RP-111692	1006	CQI reporting accuracy test on frequency non-selective scheduling on eDL MIMO	10.5.0
12-2011	RP-54	RP-111692	1007	CQI reporting accuracy test on frequency-selective scheduling on eDL MIMO	10.5.0
12-2011	RP-54	RP-111692	1008	PMI reporting accuracy test for TDD on eDL MIMO	10.5.0
12-2011	RP-54		1009r	<u> </u>	10.5.0
		RP-111692	1	CR for TS 36.101: RI performance requirements	
12-2011	RP-54		1010r		10.5.0
03-2012	RP-55	RP-111692 RP-120291	1014	CR for TS 36.101: Introduction of static CQI tests (Rel-10) RF: Updates and corrections to the RMC-s related annexes	10.6.0
03-2012	RP-55	RP-120300	1015r	(Rel-10) On elCIC ABS pattern	10.6.0
03-2012	RP-55	RP-120300	1 1016r	On elCIC interference models	10.6.0
03-2012	RP-55	RP-120299	1 1017r	TS36.101 CR: on eDL-MIMO channel model using cross-	10.6.0
03-2012	RP-55	RP-120304	1 1020r	polarized antennas TS36.101 CR: Correction to MBMS Performance Test	10.6.0
03-2012	101-55	101-120304	1	Parameters	10.0.0
03-2012	RP-55	RP-120303	1021	Harmonic exceptions in LTE UE to UE co-ex tests	10.6.0
03-2012	RP-55	RP-120304	1023	Unified titles for Rel-10 CSI tests	10.6.0
03-2012	RP-55	RP-120300	1033r	Introduction of reference channel for eICIC demodulation	10.6.0
03-2012	RP-55	RP-120304	1040r 1	Correction of Actual code rate for CSI RMCs	10.6.0
03-2012	RP-55	RP-120304	1041r	Definition of synchronized operation	10.6.0
03-2012	RP-55	RP-120296	1048r	Intra band contiguos CA Ue to Ue Co-ex	10.6.0
03-2012	RP-55	RP-120296	1049r 1	REL-10 CA specification editorial consistency	10.6.0
03-2012	RP-55	RP-120299	1053	Beamforming model for TM9	10.6.0
03-2012	RP-55	RP-120296	1054	Requirement for CA demodulation with power imbalance	10.6.0
03-2012	RP-55	RP-120298	1057	Updating Band 23 duplex specifications	10.6.0
03-2012	RP-55	RP-120298	1058r	Correcting UE Coexistence Requirements for Band 23	10.6.0
03-2012	RP-55	RP-120304	1 1059r	CA demodulation performance requirements for LTE TDD	10.6.0
02.2042	DD 55	DD 400004	1061	Paguiroment for CA CDD CDD test according	10.6.0
03-2012	RP-55	RP-120304	1061	Requirement for CA SDR FDD test scenario	10.6.0
03-2012	RP-55	RP-120293	1064r 1	TS36.101 RF editorial corrections Rel 10	10.6.0
03-2012	RP-55	RP-120299	1067r 1	Introduction of TM9 demodulation performance requirements	10.6.0
03-2012	RP-55	RP-120304	1071r 1	Introduction of a CA demodulation test for UE soft buffer management testing	10.6.0
03-2012	RP-55	RP-120296	1072	MPR formula correction For intra-band contiguous CA	10.6.0

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00.0040	DD CC	DD 400000	4077-	Bandwidth Class C	40.00
03-2012	RP-55	RP-120303	1077r 1	CR for 36.101: B41 REFSENS and MOP changes to accommodate single filter architecture	10.6.0
03-2012	RP-55	RP-120300	1082	TM3 tests for eICIC	10.6.0
03-2012	RP-55	RP-120300	1083r	Introduction of requirements of CQI reporting definition for	10.6.0
			1	eclCIC	
03-2012	RP-55	RP-120304	1084	eDL MIMO CSI requirements	10.6.0
03-2012	RP-55	RP-120306	1070r	Introduction of Band 26/XXVI to TS 36.101	11.0.0
03-2012	RP-55	RP-120310	1074	Band 41 CA CR for TS36.101, section 5	11.0.0
03-2012	RP-55	RP-120310	1075r	Band 41 CA CR for TS36.101, section 6	11.0.0
			1		
03-2012	RP-55	RP-120310	1076	Band 41 CA CR for TS36.101, section 7	11.0.0
06-2012	RP-56	RP-120795	1085r 2	Modulator specification tightening	11.1.0
00-2012	KF-30	KF-120795	1087r	Modulator specification tigritering	11.1.0
06-2012	RP-56	RP-120777	1	Carrier aggregation Relative power tolerance, removal of TBD.	11.1.0
06-2012	RP-56	RP-120783	1089	UE spurious emissions for Band 7 and Band 38 coexistence	11.1.0
		DD 400000		Deleting square brackets in Reference Measurement	
06-2012	RP-56	RP-120780	1092	Channels CR to TS36.101: Correction on parameters for the eDL-MIMO	11.1.0
06-2012	RP-56	RP-120779	1097	CQI and PMI tests	11.1.0
00 2012	111 00	141 120770	1001	CR to TS36.101: Fixed reference channel for PDSCH	111110
				demodulation performance requirements on eDL-MIMO –	
		DD 400000	1098r	NOT implemented as it is based on a wrong version of the	
06-2012 06-2012	RP-56 RP-56	RP-120780 RP-120774	1 1107	spec RMC correction on eDL-MIMO RI test	11.1.0 11.1.0
06-2012	RP-56	RP-120774	1107 1108r	FRC correction on frequency selective CQI and PMI test (Rel-	11.1.0
00 2012	111 00	10 120774	1	11)	11.1.0
06-2012	RP-56	RP-120774	1111	Correction on test point for PMI test (Rel-11)	11.1.0
06-2012	RP-56	RP-120784	1114r	Corrections and clarifications on elCIC demodulation test	11.1.0
06-2012	RP-56	RP-120784	1 1117r	Corrections and clarifications on elCIC CSI tests	11.1.0
06-2012	KP-30	RP-120764	1 1 1 1 1 1	Corrections and claimcations on eloic CSI tests	11.1.0
06-2012	RP-56	RP-120783	1119r	Corrections on UE performance requirements	11.1.0
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06-2012	RP-56	RP-120773	1120	Introduction of CA band combination Band1 + Band19 to TS	11.1.0
06-2012	RP-56	RP-120769	1127	36.101 Addition of ETU30 channel model	11.1.0
06-2012	RP-56	RP-120773	1140	Addition of Maximum Throughput for R.30-1 TDD RMC	11.1.0
06-2012	RP-56	RP-120779	1141	CR for 36.101: The clarification of MPR and A-MPR for CA	11.1.0
06-2012	RP-56	RP-120784	1142	Corrections for eICIC demod test case with MBSN ABS	11.1.0
06-2012	RP-56	RP-120785	1144	Removing brackets of contiguous allocation A-MPR for	11.1.0
06-2012	RP-56	RP-120784	1149r	CA_NS_04 Introduction of PDCCH test with colliding RS on MBSFN-ABS	11.1.0
00-2012	KF-30	KF-120704	1	Introduction of FDCCIT test with comaining No on MbSi N-AbS	11.1.0
06-2012	RP-56	RP-120784	1153r	Some clarifications and OCNG pattern for elCIC demodulation	11.1.0
			1	requirements	
06-2012	RP-56	RP-120773	1155	Introduction of TDD CA Soft Buffer Limitation	11.1.0
06-2012 06-2012	RP-56 RP-56	RP-120795 RP-120779	1156 1161	B26 and other editorial corrections Corrections on CQI and PMI test	11.1.0 11.1.0
06-2012	RP-56	RP-120780	1163	FRC for TDD PMI test	11.1.0
06-2012	RP-56	RP-120778	1165r	Clean-up of UL-MIMO for TS36.101	11.1.0
			1		
06-2012	RP-56	RP-120782	1171	Removal of unnecessary references to single carrier	11.1.0
06-2012	RP-56	RP-120781	1174	requirements from Interband CA subclauses PDCCH wrong detection in receiver spurious emissions test	11.1.0
06-2012	RP-56	RP-120776	1184	Corrections to 3500 MHz	11.1.0
06-2012	RP-56	RP-120793	1189r	Introduction of Band 44	11.1.0
			2		
06-2012	RP-56	RP-120784	1193r	Target SNR setting for elCIC demodulation requirement	11.1.0
06-2012	RP-56	RP-120780	1196	Editorial simplification to CA REFSENS UL allocation table	11.1.0
06-2012	RP-56	RP-120778	1199	Correction of wrong table refernces in CA receiver tests	11.1.0
06-2012	RP-56	RP-120791	1200r	Introduction of e850_LB (Band 27) to TS 36.101	11.1.0
00.00:-	DE	DB 105=5:	1	(44.5
06-2012 06-2012	RP-56	RP-120764 RP-120793	1212 1213r	Correction of PHS protection requirements for TS 36.101 Introduction of Band 28 into TS36.101	11.1.0 11.1.0
00-2012	7C-30	KP-120/93	1213r 1	Introduction of Band 20 Into 1530.101	11.1.0
06-2012	RP-56	RP-120781	1215r	Proposed revision of subclause 4.3A for TS36.101	11.1.0
			1		
06-2012	RP-56	RP-120781	1217r	Proposed revision on subclause 6.3.4A for TS36.101	11.1.0
06-2012	RP-56	RP-120795	1 1219r	Aligning requirements between Band 18 and Band 26 in	11.1.0
00 2012	111 -30	131 - 120193	12 191	TS36.101	11.1.0
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06-2012	RP-56	RP-120782	1221	SNR definition	11.1.0
06-2012	RP-56	RP-120762	1223	Correction of CSI configuration for CA TM4 tests R11	11.1.0
06-2012	RP-56	RP-120773	1225	CR on CA UE receiver timing window R11	11.1.0
06-2012	RP-56	RP-120784	1226	Extension of static elCIC CQI test Correct Transport Block size in 9RB 16QAM Uplink Reference	11.1.0
09-2012	RP-57	RP-121294	1230	Measurement Channel	11.2.0
09-2012	RP-57	RP-121313	1233r 1	RF: Corrections to power allocation parameters for transmission mode 8 (Rel-11)	11.2.0
09-2012	RP-57	RP-121304	1235	RF-CA: non-CA notation and applicability of test points in scenarios without and with CA operation (Rel-11)	11.2.0
09-2012	RP-57	RP-121305	1237	ACK/NACK feedback modes for FDD and TDD TM4 CA demodulation requirements (Rel-11)	11.2.0
09-2012	RP-57	RP-121305	1239	Correction of feedback mode for CA TDD demodulation requirements (resubmission of R4-63AH-0194 for Rel-11)	11.2.0
09-2012	RP-57	RP-121302	1241	ABS pattern setup for MBSFN ABS test (resubmission of R4-63AH-0204 for Rel-11)	11.2.0
09-2012	RP-57	RP-121302	1243	CR on elCIC CQI definition test (resubmission of R4-63AH- 0205 for Rel-11)	11.2.0
09-2012	RP-57	RP-121302	1245	Transmission of CQI feedback and other corrections (Rel-11)	11.2.0
09-2012	RP-57	RP-121302	1247	Target SNR setting for eICIC MBSFN-ABS demodulation requirements (Rel-11)	11.2.0
09-2012	RP-57	RP-121335	1248		11.2.0
09-2012	RP-57	RP-121335	1246	Introduction of CA_1_21 RF requirements into TS36.101 Corrections of spurious emission band UE co-existence	11.2.0
	<u> </u>			applicable in Japan	
09-2012	RP-57	RP-121306	1253	Correction on RMC for frequency non-selective CQI test	11.2.0
09-2012	RP-57	RP-121306	1255	Requirements for the eDL-MIMO CQI test	11.2.0
09-2012	RP-57	RP-121302	1257	Clarification on PDSCH test setup under MBSFN ABS	11.2.0
09-2012	RP-57	RP-121316	1258	Update of Band 28 requirements	11.2.0
09-2012	RP-57	RP-121313	1262	Applicabilty of statement allowing RBW < Meas BW for spurious	11.2.0
09-2012	RP-57	RP-121298	1265	Clarification of RB allocation for DRS demodulation tests	11.2.0
09-2012	RP-57	RP-121304	1267	Removal of brackets for CA Tx	11.2.0
09-2012	RP-57	RP-121337	1268r	TS 36.101 CR for CA_38	11.2.0
09-2012	RP-57	RP-121327	1269	Introduction of CA B7 B20 in 36.101	11.2.0
09-2012	RP-57	RP-121313	1271	Corrections of FRC subframe allocations and other minor problems	11.2.0
09-2012	RP-57	RP-121305	1274	Introduction of requirements for TDD CA Soft Buffer Limitation	11.2.0
09-2012	RP-57	RP-121307	1276	Correction of eDL-MIMIO CSI RMC tables and references	11.2.0
09-2012	RP-57	RP-121307	1278	Correction of MIMO channel model for polarized antennas	11.2.0
09-2012	RP-57	RP-121303	1280	Addition of 15 and 20MHz Bandwidths for Band 23 to TS 36.101 (Rel-11)	11.2.0
09-2012	RP-57	RP-121334	1283r	Add requirements for inter-band CA of B_1-18 and B_11-18 in TS36.101	11.2.0
09-2012	RP-57	RP-121304	1285r 1	CR for MPR mask for multi-clustered simultaneous transmission in single CC in Rel-11	11.2.0
09-2012	RP-57	RP-121447	1288r 2	Introduction of Japanese Regulatory Requirements to LTE Band 8(R11)	11.2.0
09-2012	RP-57	RP-121315	1289	CR for Band 27 MOP	11.2.0
09-2012	RP-57	RP-121315	1290	CR for Band 27 A-MPR	11.2.0
09-2012	RP-57	RP-121316	1290	CR to replace protected frequency range with new band	11.2.0
				number 27	
09-2012	RP-57	RP-121215	1292r 1	Introduction of CA band combination Band3 + Band5 to TS 36.101	11.2.0
09-2012	RP-57	RP-121306	1300r 1	Requirements for eDL-MIMO RI test	11.2.0
09-2012	RP-57	RP-121306	1304	Corrections to TM9 demodulation tests	11.2.0
09-2012	RP-57	RP-121313	1306	Correction to PCFICH power parameter setting	11.2.0
09-2012	RP-57	RP-121306	1310r 1	Correction on frequency non-selective CQI test	11.2.0
09-2012	RP-57	RP-121306	1313r	eDL-MIMO CQI/PMI test	11.2.0
09-2012	RP-57	RP-121313	1316	Correction of the definition of unsynchronized operation	11.2.0
09-2012	RP-57	RP-121304	1320r	Correction to Transmit Modulation Quality Tests for Intra-Band CA	11.2.0
09-2012	RP-57	RP-121338	1324r	36.101 CR for LTE_CA_B7	11.2.0
00.2042	RP-57	DD 404004	1325	Introduction of CA 2, 20 DE requirements into T020 404	11 2 2
09-2012 09-2012	RP-57	RP-121331	1325	Introduction of CA_3_20 RF requirements into TS36.101 A-MPR table correction for NS_18	11.2.0 11.2.0
	RP-57	RP-121316 RP-121304		Bandwidth combination sets for intra-band and inter-band	
09-2012			1332r 1	carrier aggregation	11.2.0
09-2012	RP-57	RP-121325	1339	Introduction of LTE Advanced Carrier Aggregation of Band 4 and Band 13	11.2.0
09-2012	RP-57	RP-121326	1340r	Introduction of CA configurations CA-12A-4A and CA-17A-4A	11.2.0

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09-2012	RP-57	RP-121324	1341	Introduction of CA_B3_B7 in 36.101	11.2.0
09-2012	RP-57	RP-121328	1343	Introduction of CA_S3_B7 in 36.101 Introduction of Band 2 + Band 17 inter-band CA configuration into 36.101	11.2.0
09-2012	RP-57	RP-121306	1351	FRC for TM9 FDD	11.2.0
09-2012	RP-57	RP-121295	1352	Random precoding granularity in PMI tests	11.2.0
09-2012	RP-57	RP-121302	1358	Introduction of RI test for eICIC	11.2.0
09-2012	RP-57	RP-121304	1360	Notes for deltaTib and deltaRib tables	11.2.0
09-2012	RP-57	RP-121304			
			1361	CR for A-MPR masks for NS_CA_1C	11.2.0
12-2012	RP-58	RP-121884	1362	Introduction of CA_3_8 RF requirements to TS 36.101	11.3.0
12-2012	RP-58	RP-121870	1363	Removal of square brackets for Band 27 in Table 5.6.1-1	11.3.0
12-2012	RP-58	RP-121861	1366	Some changes related to CA tests and overview table of DL measurement channels	11.3.0
12-2012	RP-58	RP-121860	1368	Correction of eICIC CQI tests	11.3.0
12-2012	RP-58	RP-121860	1370	Correction of eICIC demodulation tests	11.3.0
12-2012	RP-58	RP-121862	1374	Correction on CSI-RS subframe offset parameter	11.3.0
12-2012	RP-58	RP-121862	1376	Correction on FRC table in CSI test	11.3.0
12-2012	RP-58	RP-121862	1382	Correction of reference channel table for TDD eDL-MIMIO RI test	11.3.0
12-2012	RP-58	RP-121850	1386	OCNG patterns for Sustained Data rate testing	11.3.0
12-2012	RP-58	RP-121867	1388r	Introduction of one periodic CQI test for CA deployments	11.3.0
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12-2012	RP-58	RP-121894	1396	Introduction of CA_B5_B12 in 36.101	11.3.0
12-2012	RP-58	RP-121850	1401	Introducing the additional frequency bands of 5 MHz x 2 in 1.7	11.3.0
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12-2012	RP-58	RP-121887	1406r 1	Reference sensitivity for the small bandwidth of CA_4-12	11.3.0
12-2012	RP-58	RP-121860	1407	CR on elCIC RI test	11.3.0
12-2012	RP-58	RP-121862	1409	Cleaning of 36.101 Performance sections Rel-11	11.3.0
12-2012	RP-58	RP-121861	1416	Out-of-band blocking requirements for inter-band carrier aggregation	11.3.0
12-2012	RP-58	RP-121861	1418	Adding missed SNR reference values for CA soft buffer tests	11.3.0
12-2012	RP-58	RP-121890	1422	Introduction of CA_4A-5A into 36.101	11.3.0
12-2012	RP-58	RP-121867	1431	Clean up of specification R11	11.3.0
12-2012	RP-58	RP-121867	1436	Band 1 to Band 33 and Band 39 UE coexistence requirements	11.3.0
12-2012	RP-58	RP-121871	1430 1437r	Editorial corrections for Band 26	11.3.0
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12-2012	RP-58	RP-121896	1438	Introduction of Band 5 + Band 17 inter-band CA configuration into 36.101 Correction of eDL-MIMO RI test and RMC table for the CSI	11.3.0
12-2012	RP-58	RP-121862		test	11.3.0
12-2012	RP-58	RP-121861	1444	Minor correction to ceiling function example - rel11	11.3.0
12-2012	RP-58	RP-121862	1449	Correction of SNR definition	11.3.0
12-2012	RP-58	RP-121860	1450	Brackets clean up for eICIC CSI/demodulation	11.3.0
12-2012	RP-58	RP-121860	1455	CR on elCIC RI testing (Rel-11)	11.3.0
12-2012	RP-58	RP-121862	1459	Correction on FRC table	11.3.0
12-2012	RP-58	RP-121879	1461r 1	CR for LTE B14 HPUE (Power Class 1)	11.3.0
12-2012	RP-58	RP-121862	1464	Adding references to the appropriate beamforming model	11.3.0
12-2012	RP-58	RP-121898	1465r	(Rel-11) Introduction of CA_8_20 RF requirements into TS36.101	11.3.0
12-2012	RP-58	RP-121882	1 1468r	Introduction of inter-band CA_11-18 into TS36.101	11.3.0
12-2012	RP-58	RP-121903	1 1472r	Introduction of advanced receivers demodulation performance	11.3.0
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12-2012	RP-58	RP-121903	1473r 1	Introduction of performance requirements for verifying the receiver type for advanced receivers (FDD/TDD)	11.3.0
12-2012	RP-58	RP-121886	1474	CR to remove the square bracket of A-MPR in TS36.101	11.3.0
12-2012	RP-58	RP-121861	1476	Correction of some errors in reference sensitivity for CA in TS 36.101 (R11)	11.3.0
12-2012	RP-58	RP-121903	1480r 1	Introduction of Advanced Receivers Test Cases for TDD	11.3.0
12-2012	RP-58	RP-121901	1490r	Introduction of Band 29	11.3.0
12-2012	RP-58	RP-121849	1494	Low-channel Band 1 coexistence with PHS	11.3.0
12-2012	RP-58	RP-121861	1498r	Completion of the tables of bandwidth combinations specified	11.3.0
12-2012	RP-58	RP-121861	1 1499r	for CA Exceptions to REFSENS requirements for class A2 CA	11.3.0
40.0015	DD 55	DD 101222	1 4500	combinations	44.0.0
12-2012	RP-58	RP-121892	1500	Introduction of carrier aggregation configuration CA_4-7	11.3.0
12-2012	RP-58	RP-121870	1504	Editorial corrections to Band 27 specifications	11.3.0
12-2012	RP-58	RP-121878	1505	Band 28 AMPR for DTV protection	11.3.0
12-2012	RP-58	RP-121852	1509r	UE-UE coexistence between bands with small frequency	11.3.0

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10.0010	DD 50	DD 404044	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	separation	44.0.0
12-2012	RP-58	RP-121911	1510	Adding UE-UE Coexistence Requirement for Band 3 and Band 26	11.3.0
12-2012	RP-58	RP-121866	1513	Maintenance of Band 23 UE Coexistence	11.3.0
12-2012	RP-58	RP-121851	1515	Corrections to TM4 rank indicator Test 3	11.3.0
12-2012	RP-58	RP-121861	1517	Correction of test configurations and FRC for CA demodulation with power imbalance	11.3.0
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03-2013	RP-59	RP-130279	1519	OCNG patterns for Enhanced Performance Requirements Type A	11.4.0
03-2013	RP-59	RP-130277	1520	Corrections on in-band blocking for Band 29 for carrier aggregation	11.4.0
03-2013	RP-59	RP-130268	1523	Brackets removal in Rel-11 TM4 rank indicator Test 3	11.4.0
03-2013	RP-59	RP-130279	1524r 1	Cleanup of Advanced Receivers requirement scenarios for demodulation and CSI (FDD/TDD)	11.4.0
03-2013	RP-59	RP-130258	1528	Corrections to CQI reporting	11.4.0
03-2013	RP-59	RP-130262	1536	Corrections for elCIC performance requirements (rel-11)	11.4.0
03-2013	RP-59	RP-130264	1539	Correction of CA power imbalance performance requirements	11.4.0
03-2013	RP-59	RP-130287	1543	Correction of a symbol for MPR in single carrier for TS 36.101(R11)	11.4.0
03-2013	RP-59	RP-130287	1544r 1	Correction of some inter-band CA requiements for TS 36.101 (R11)	11.4.0
03-2013 03-2013	RP-59 RP-59	RP-130276 RP-130263	1546 1547r	Correction of contigous allocation A-MPR for CA_NS_05 Clarification of spurious emission domain for CA in TS 36.101	11.4.0 11.4.0
00.0015	DD 50	DD 400001	1 1540	(R11)	44.46
03-2013	RP-59	RP-130264	1548	CR for CA performance requirements Introduction of downlink non-contiguous CA into REL -11 TS	11.4.0
03-2013	RP-59	RP-130284	1553r 1	36.101	11.4.0
03-2013	RP-59	RP-130263	1557	CA_1C: CA_NS_02 and CA_NS_03 A-MPR REL-11	11.4.0
03-2013	RP-59	RP-130287	1560	Editorial corrections to subclause 5	11.4.0
03-2013	RP-59	RP-130267	1562	Addition of UE Regional Requirements to Band 23 Based on New Regulatory Order in the US	11.4.0
03-2013	RP-59	RP-130272	1567	Band 26: modification of A-MPR for 'NS_15'	11.4.0
03-2013	RP-59	RP-130287	1571r 1	Band 41 requirements for operation in China and Japan	11.4.0
03-2013	RP-59	RP-130260	1574	Remove [] from CSI test case parameters	11.4.0
03-2013	RP-59	RP-130287	1575	Corrections to UE co-existence	11.4.0
03-2013 03-2013	RP-59 RP-59	RP-130287 RP-130287	1579 1580	UE-UE co-existence between Band 1 and Band 33/39 Correction on reference to note for Band 7 and 38 co-	11.4.0 11.4.0
03-2013	RP-59	RP-130263	1584r	existence Cleanup for CA UE RF requirements	11.4.0
03-2013	RP-59	RP-130263	1 1586	Corrections on UL configuration for CA UE receiver	11.4.0
03-2013	RP-59	RP-130263	1588	requirements Correction of Transmit modulation quality requirements for CA	11.4.0
03-2013	RP-59	RP-130268	1590	Revision of Common Test Parameters for User-specific Demodulation Tests	11.4.0
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03-2013	RP-59	RP-130287	1600r	Correction of B12 DL Specification in Table 5.5A-2	11.4.0
03-2013	RP-59	RP-130263	1602	Correction of table reference	11.4.0
06-2013	RP-60	RP-130765	1604r 1	Complementary description for definition of MIMO Correlation Matrices using cross polarized antennas	11.5.0
06-2013	RP-60	RP-130763	1607	Correction of transport format parameters for CQI index 10 (15 RBs) - Rel 11	11.5.0
06-2013	RP-60	RP-130765	1610	Maintenance of Band 23 A-MPR (NS_11) in TS 36.101 (Rel-	11.5.0
06-2013	RP-60	RP-130770	1613	CR for 36.101 : Adding the definition of CA_NS_05 and CA_NS_06 for additional spurious emissions for CA	11.5.0
06-2013	RP-60	RP-130770	1619	CR for introducing UE TM3 demodulation performance requirements under high speed	11.5.0
06-2013	RP-60	RP-130765	1623	Correction of test parameters for elCIC performance requirements	11.5.0
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06-2013	RP-60	RP-130766	1629	Removal of note 2 from band 28	11.5.0
06-2013	RP-60	RP-130770	1641	Correction of the CSI-RS parameter configuration	11.5.0
06-2013	RP-60	RP-130770	1650r	Addition of Band 41 for intra-band non-contiguous CA for	11.5.0
06-2013	RP-60	RP-130770	1 1654r	36.101 MPR for intra-band non-contiguous CA	11.5.0
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06-2013	RP-60	RP-130765	1656	Modification of configured output power to account for larger tolerance	11.5.0
06-2013	RP-60	RP-130769	1658r 1	Missing symbols in the NS_15 table	11.5.0
06-2013	RP-60	RP-130766	1673	Corrections to Rx requirements for inter-band CA configurations with REFSENS exceptions	11.5.0
06-2013	RP-60	RP-130770	1681r 1	Correction for TS 36.101	11.5.0
06-2013	RP-60	RP-130763	1684	RF: Corrections to RMC-s for sustained data rate test	11.5.0
06-2013	RP-60	RP-130770	1685	Non-contiguous intraband CA channel spacing	11.5.0
06-2013	RP-60	RP-130766	1689	Carrier aggregation in multi RAT and multiple band combination terminals	11.5.0
06-2013	RP-60	RP-130766	1691	Completion of out-of-band blocking requirements for inter- band CA with one UL	11.5.0
06-2013	RP-60	RP-130767	1695r 1	CR on the bandwidth coverage issue of CA demodulation performance (Rel-11)	11.5.0
06-2013	RP-60	RP-130765	1697	Correction on UE maximum output power for intra-band CA (R11)	11.5.0
06-2013	RP-60	RP-130770	1698r 1	CR for introduction of FeICIC demodulation performance requirements	11.5.0
06-2013	RP-60	RP-130770	1701	Removing bracket from CA_11A-18A requirments	11.5.0
06-2013	RP-60	RP-130767	1703	CR on the bandwidth coverage issue of CA CQI performance (Rel-11)	11.5.0
06-2013	RP-60	RP-130766	1705	Corrections to ACLR for Rel-11 CA	11.5.0
06-2013	RP-60	RP-130765	1716	Corrections to NS_11 A-MPR Table	11.5.0
06-2013	RP-60	RP-130769	1717	Corrections to NS_12 A-MPR Table	11.5.0
06-2013	RP-60	RP-130771	1532r 1	Introduction of CA 1+8 into TS36.101(Rel-12)	12.0.0
06-2013	RP-60	RP-130781	1545r 1	Introduction of LTE Advanced inter-band Carrier Aggregation of Band 3 and Band 28 to TS 36.101	12.0.0
06-2013	RP-60	RP-130785	1608r 1	Introduction of LTE Advanced inter-band Carrier Aggregation of Band 23 and Band 29 to TS 36.101	12.0.0
06-2013	RP-60	RP-130777	1642r 1	Introduction of CA B3+19 into TS36.101(Rel-12)	12.0.0
06-2013	RP-60	RP-130787	1687	Introduction of CA_4A-4A into 36.101	12.0.0
06-2013	RP-60	RP-130795	1712	Adding 5MHz CBW for B3 of Inter band CA of B3+26	12.0.0
06-2013	RP-60	RP-130775	1713r 1	Introduction of LTE Advanced Inter-Band Carrier Aggregation of Band 2 and Band 13	12.0.0
06-2013	RP-60	RP-130790	1723r	Introduction of the LTE 450 band to TS 36.101	12.0.0
06-2013	RP-60	RP-130791	1724r	Introduction of the WCS band to TS 36.101	12.0.0
06-2013	RP-60	RP-130784	1707r	Introduction of CA 19+21 into TS36.101(Rel-12)	12.0.0
09-2013	RP-61	RP-131300	1730r 1	36.101 CR for LTE_CA_C_B3	12.1.0
09-2013	RP-61	RP-131285	1732	CR on performance requirements of CA soft buffer managemen (Rel-12)	12.1.0
09-2013	RP-61	RP-131303	1733r 1	CR to introdue TM3 and TM4 test for 5MHz channel bandwidth	12.1.0
09-2013	RP-61	RP-131281	1736	CR on applicability of CA sustained data rate tests (Rel-12)	12.1.0
09-2013	RP-61	RP-131293	1739	Performance requirement for UE under EVA200	12.1.0
09-2013	RP-61	RP-131290	1743	CR for introduction of FeICIC PBCH performance requirement	12.1.0
09-2013	RP-61	RP-131290	1745	CR for introduction of FeICIC RI reporting requirements	12.1.0
09-2013	RP-61	RP-131292	1747	Beamforming model for EPDCCH test	12.1.0
09-2013 09-2013	RP-61 RP-61	RP-131303 RP-131303	1748 1749	CR to introduce CSI tests for LTE450 CR to extend UE category of the existing 5MHz performance	12.1.0 12.1.0
09-2013	RP-61	RP-131281	1767	requirements UE REFSENS when supporting intra-band CA and inter-band	12.1.0
09-2013	RP-61	RP-131279	1772	CA Correlation matrix for high speed train demodulation scenarios	12.1.0
09-2013	RP-61	RP-131280	1776	(Rel-12) Corrections to sustained data rate test (Rel-12)	12.1.0
09-2013	RP-61	RP-131303	1781	CR to introduce a new PHICH test based on 5MHz	12.1.0
09-2013	RP-61	RP-131303	1782	CR placeholder for applicability of new 5MHz tests	12.1.0
09-2013	RP-61	RP-131303	1783r 1	CR : Proposal of applicability of new 5MHz tests	12.1.0
09-2013	RP-61	RP-131303	1784	CR: PHICH tests for 5MHz	12.1.0
09-2013	RP-61	RP-131290	1786	CR for introduction of FelCIC CQI requirements	12.1.0
09-2013	RP-61	RP-131281	1794	Clarification of multi-cluster transmission	12.1.0
09-2013	RP-61	RP-131294	1800r 1	CA UE Coexistence Table update (Release 12)	12.1.0
09-2013	RP-61	RP-131302	1802	Coexistence between Band 27 and Band 38 (Release 12)	12.1.0
09-2013	RP-61	RP-131285	1803	Addional requirement for CA_1A-18A into TS36.101	12.1.0

09-2013	RP-61	RP-131296	1804	Add requirements for CA_1A-26A into TS36.101	12.1.0
09-2013	RP-61	RP-131281	1807	Incorrect REFSENS UL allocation for CA_1C	12.1.0
09-2013	RP-61	RP-131297	1808r 1	Introduction of CA_2A-4A into 36.101	12.1.0
09-2013	RP-61	RP-131281	1811	Contiguous intraband CA REFSENS with one UL	12.1.0
09-2013	RP-61	RP-131281	1822	The Pcmax clauses restructured: This CR was NOT implemented as it was based on the wrong version of the spec	12.1.0
09-2013	RP-61	RP-131298	1824	Introduction of inter-band CA Band 2+5	12.1.0
09-2013	RP-61	RP-131285	1831	MPR for intra-band non-contiguous CA	12.1.0
09-2013	RP-61	RP-131281	1832	Correction to Rel-10 A-MPR for CA_NS_04	12.1.0
09-2013	RP-61	RP-131285	1834	CR for 36.101 : Add the definition of 5+20MHz for spectrum emission mask for CA	12.1.0
09-2013	RP-61	RP-131303	1839	CR to introduce CSI tests for LTE450	12.1.0
09-2013	RP-61	RP-131293	1840	Remianed Transmitter requirements for intra-band non- contiguous CA	12.1.0
09-2013	RP-61	RP-131303	1841	CR to introdue TM3 and TM4 test for 5MHz channel bandwidth	12.1.0
12-2013	RP-62	RP-131928	1847r 1	Corrections to the notes in the band UE co-existence requirements table (Rel-12)	12.2.0
12-2013	RP-62	RP-131924	1852	Clean-up of uplink reference measurement channels (Rel-12)	12.2.0
12-2013	RP-62	RP-131946	1857	Introduction of CA band combination Band2 + Band12 to TS 36.101	12.2.0
12-2013	RP-62	RP-131954	1858	Introduction of CA band combination Band12 + Band25 to TS 36.101	12.2.0
12-2013	RP-62	RP-131931	1867	CA_NS_05 Emissions	12.2.0
12-2013	RP-62	RP-131939	1869	NS signaling for CA refsens	12.2.0
12-2013	RP-62	RP-131965	1870	Introduction of CA_23A-23A RF requirements into 36.101	12.2.0
12-2013	RP-62	RP-131928	1877r 2	Intraband CA channel bandwidth combination table restructuring	12.2.0
12-2013	RP-62	RP-131940	1878	Addition of CA_3C missing UE to UE co-existence requirement and corection to SEM	12.2.0
12-2013	RP-62	RP-131959	1885	Introduction of LTE_CA_C_B27 to 36.101	12.2.0
12-2013	RP-62	RP-131939	1887	CR on correction of definition on Fraction of Maximum Throughput for CA	12.2.0
12-2013	RP-62	RP-131939	1889	CR on correction of test configurations of CA soft buffer tests	12.2.0
12-2013	RP-62	RP-131936	1893	CR for FeICIC demodulation performance requirements	12.2.0
12-2013	RP-62	RP-131936	1895r 1	CR on FelCIC PBCH performance requirement	12.2.0
12-2013	RP-62	RP-131936	1897r 1	CR on RI reporting requirement	12.2.0
12-2013	RP-62	RP-131938	1899	Beamforming model for EPDCCH localized test	12.2.0
12-2013	RP-62	RP-131938	1901	Downlink physical setup for EPDCCH test	12.2.0
12-2013	RP-62 RP-62	RP-131926	1904	Correction on the UE category for eICIC CQI test	12.2.0
12-2013		RP-131931	1906	CR for receiver type verification test of CSI-RS based advanced receivers (Rel-12)	12.2.0
12-2013	RP-62	RP-131956	1910r 1	Spurious emission band UE co-existence requirements for cross-region issue	12.2.0
12-2013	RP-62	RP-131928	1916r 2	Allowed power reductions for multiple transmissions in a subframe	12.2.0
12-2013	RP-62	RP-131967	1917r 1	The coexistence requirements between Band 39 and Band 3	12.2.0
12-2013	RP-62	RP-131967	1918r 1	The Pcmax clauses restructured and removal of addition of <u>ATc</u> to P-MPR	12.2.0
12-2013	RP-62	RP-131956	1919	Configured maximum output power for multiple TAG transmission Configured maximum output power for multiple TAG	12.2.0
12-2013	RP-62	RP-131936	1927r 1	transmission	12.2.0
12-2013	RP-62	RP-131927 RP-131927	1934	CR on correction of FRC of power imbalance test	12.2.0
12-2013 12-2013	RP-62 RP-62	RP-131927 RP-131957	1937	UE-UE coexistence for Band 40 Introduction of LTE Advanced intra-band contiguous Carrier	12.2.0
12-2013	RP-62	RP-131957	1955r 1 1956r	Aggregation in Band 23 to TS 36.101	12.2.0
			1	Introduction of CA_3A-3A into TS 36.101	
12-2013	RP-62	RP-131937	1957	CR Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource)	12.2.0
12-2013	RP-62	RP-131937	1958	CR Minimum requirement with Same Cell ID (with multiple NZP CSI-RS resources)	12.2.0
12-2013	RP-62	RP-131936	1962	Introduction of reference SNR-s for FeICIC demodulation performance requirements	12.2.0
12-2013	RP-62	RP-131938	1964	OCNG pattern for EPDCCH test	12.2.0
12-2013	RP-62	RP-131931	1965	CA performance requirements for TDD intra-band NC CA	12.2.0
12-2013	RP-62	RP-131958	1966r 1	CA performance requirements for TDD intra-band NC CA	12.2.0
12-2013	RP-62	RP-131939	1968	Introduction of UE TM3 demodulation performance requirements under ETU300	12.2.0

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12-2013 12-2013	RP-62 RP-62	RP-131937 RP-131939	1970 1972	Introduction of test 1-A for CoMP Modification of TM9 test to verify correct SNR estimation	12.2.0 12.2.0
12-2013	RP-62	RP-131939	1972	Correction to blocking requirements and use of Delta_RIB	12.2.0
12-2013	RP-62	RP-131950	1985	Introduction of CA band combination Band5 + Band25 to TS 36.101	12.2.0
12-2013	RP-62	RP-131939	1988r 1	CR on test point clarification for CA demodulation test	12.2.0
12-2013	RP-62	RP-131937	1994	CR to Introduce fading CQI test for CoMP (TDD)	12.2.0
12-2013	RP-62	RP-131937	1996	CR to Introduce channel model for CoMP fading CQI tests	12.2.0
12-2013	RP-62	RP-131937	1998	CR to Introduce RI test for CoMP (FDD)	12.2.0
12-2013	RP-62	RP-131938	2001r 1	Distributed EPDCCH Demodulation Test	12.2.0
12-2013	RP-62	RP-131938	2003r	Localized EPDCCH Demodulation Test	12.2.0
12-2013	RP-62	RP-131938	2005r	Localized EPDCCH Demodulation Test	12.2.0
12-2013	RP-62	RP-131937	2007	Introduction of DL CoMP FDD static CQI test	12.2.0
12-2013	RP-62	RP-131937	2009	Introduction of DL CoMP TDD static CQI test	12.2.0
12-2013	RP-62	RP-131924	2014	P-max for Band 38 to Band 7 coexistence	12.2.0
12-2013	RP-62	RP-131948	2015	Introduction of CA band combination B5 + B7 to TS 36.101	12.2.0
12-2013	RP-62	RP-131952	2017	Introduction of CA band combination B7 + B28 to TS 36.101	12.2.0
12-2013	RP-62	RP-131937	2024	Minimum requirement with Same Cell ID (with multiple NZP CSI-RS resources) TDD	12.2.0
12-2013	RP-62	RP-131937	2026	CR Minimum requirement with Different Cell ID and Colliding CRS (with single NZP CSI-RS resource) TDD	12.2.0
12-2013	RP-62	RP-131936	2028	Editoral change on FelCIC PBCH Noc setup	12.2.0
12-2013	RP-62	RP-131937	2032	Introduction of test 1-A for CoMP	12.2.0
12-2013	RP-62	RP-131931	2035r 1	Correction of nominal guard bands for bandwidth classes A, B and C	12.2.0
12-2013	RP-62	RP-131937	2042	CR to Introduce RI test for CoMP (TDD)	12.2.0
12-2013	RP-62	RP-131937	2043	CR to Introduce fading CQI test for CoMP (FDD)	12.2.0
12-2013	RP-62	RP-131931	2045	Correction of TDD PCFICH/PDCCH test parameter table	12.2.0
12-2013	RP-62	RP-131939	2047	Add EVA200 to table of channel model parameters	12.2.0
12-2013	RP-62	RP-131963	2050r 1	Introduction of CA_7A-7A into TS 36.101	12.2.0
12-2013	RP-62	RP-131967	2057	Band 41 deployment in Japan	12.2.0
12-2013	RP-62	RP-131926	2059	CA_1C: Correction on CA_NS_02 A-MPR table	12.2.0
12-2013	RP-62	RP-131924	2060	Simplification of Band 12/17 in-band blocking test cases	12.2.0
12-2013	RP-62	RP-131967	2064	Correction of duplicated notes on table 7.3.1A-3	12.2.0
12-2013	RP-62	RP-131938	2066	Introduction of EPDCCH TM10 localized test R-12	12.2.0
12-2013	RP-62	RP-131938	2068	Introduction of SDR test for PDSCH with EPDCCH scheduling	12.2.0
03-2014	RP-63	RP-140377	2115	Editorial Correction for TS36.101 Rel-12	12.3.0
03-2014	RP-63	RP-140371	2108	UL-DL configuration and other parameters for FelCIC TDD CQI fading test (Rel-12)	12.3.0
03-2014	RP-63	RP-140374	2097	CR on TM9 localized ePDCCH test	12.3.0
03-2014	RP-63	RP-140374	2101	CR on reference measurement channel for ePDCCH test	12.3.0
03-2014	RP-63	RP-140371	2110	CR for TS36.101 COMP demodulation requirements	12.3.0
03-2014	RP-63	RP-140371	2113	CR for Combinations of channel model parameters	12.3.0
03-2014	RP-63	RP-140374	2114	CR for EPDCCH power allocation (Rel-12)	12.3.0
03-2014 03-2014	RP-63 RP-63	RP-140371 RP-140375	2106 2089	Cleanup of the specification for FelCIC (Rel-12) CR for introduction of 15MHz based single carrier and CA SDR taste in Rel 12	12.3.0 12.3.0
03-2014	RP-63	RP-140375	2080r	SDR tests in Rel-12 CR on TM3 demodulation and soft buffer management test	12.3.0
03-2014	RP-63	RP-140371	2086	CR on reference measurement channel for TM10 PDSCH demodulation test	12.3.0
03-2014	RP-63	RP-140241	2174	Introduction of 3MHz in Band 8 for CA_8_20 RF requirements into TS36.101	12.3.0
03-2014	RP-63	RP-140417	2173r	Addition of bandwidth combination set for CA_2A-29A and CA_4A-29A	12.3.0
03-2014	RP-63	RP-140387	2071r	Introduction of TDD inter-band CA_B39_B41 into 36.101	12.3.0
03-2014	RP-63	RP-140378	2069	CA_3C is adding 100RB+75RB uplink configuration for reference sensitivity	12.3.0
03-2014	RP-63	RP-140388	2070	CR for TS36.101 on CA_C_B39	12.3.0
03-2014	RP-63	RP-140386	2072	Introduction of CA band B3+B27 to TS36.101	12.3.0
03-2014	RP-63	RP-140374	2074	CR of EPDCCH localzied test with TM10 QCL Type-B configuration (Rel-12)	12.3.0
03-2014	RP-63	RP-140371	2142	Clarification of contiguous and non-contiguous intra-band UE capabilities in the same band	12.3.0
03-2014	RP-63	RP-140385	2161	Inrtroduction of additional bandwidth combination set for CA_2A-4A	12.3.0
03-2014	RP-63	RP-140371	2131r 1	CR to finalize RI test for CoMP	12.3.0

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03-2014	RP-63	RP-140368	2147	Correction of coding rate for 18RBs in UL RMC table	12.3.0
03-2014	RP-63	RP-140371	2144	Channel spacing for non-contiguous intra-band carrier	12.3.0
				aggregation	
03-2014	RP-63	RP-140374	2163	Distributed EPDCCH Demodulation Test	12.3.0
03-2014	RP-63	RP-140368	2137	Configured transmitted power for CA	12.3.0
03-2014	RP-63	RP-140368	2122	CR for 36.101. Editorial correction on OCNG pattern	12.3.0
03-2014	RP-63	RP-140370	2160	Correction of table notes for NS_12-NS_15 spurious	12.3.0
				emissions requirements	
03-2014	RP-63	RP-140371	2129r	CR to finalize fading CQI test for CoMP	12.3.0
			1		
03-2014	RP-63	RP-140375	2119	Introduction of requirements for SNR test for TM9	12.3.0
03-2014	RP-63	RP-140374	2125	CR on correction of downlink SDR tests with EPDCCH	12.3.0
				scheduling	
03-2014	RP-63	RP-140371	2127	Correction on DL CoMP static CQI tests (Rel 12)	12.3.0
06-2014	RP-64	RP-140909	2177r	RF: Corrections to spurious emission requirements with NS	12.4.0
			3	different than NS_01 (Rel-12)	
06-2014	RP-64	RP-140932	2187r	Additional bandwidth combination set for LTE Advanced inter-	12.4.0
			1	band Carrier Aggregation of Band 3 and Band 20	
06-2014	RP-64	RP-140934	2188	Additional bandwidth combination set for LTE Advanced inter-	12.4.0
				band Carrier Aggregation of Band 7 and Band 20	
06-2014	RP-64	RP-140943	2195r	CR for TS 36.101 on introduction CA_41D	12.4.0
			1		
06-2014	RP-64	RP-140943	2196r	CR to TS 36.101 on introduction of CA BW class D	12.4.0
00 20	1 0.		3	requirements	
06-2014	RP-64	RP-140918	2198	CR on correction on TDD IRC CQI test	12.4.0
06-2014	RP-64	RP-140917	2207	CR of EPDCCH localzied test with TM10 QCL Type-B	12.4.0
00 2011	141 01	141 110017	2201	configuration (Rel-12): correction of CSI-RS configurations	12.1.0
06-2014	RP-64	RP-140918	2209	Clean up of TM9 SNR tests	12.4.0
06-2014	RP-64	RP-140933	2210r	Introduction of band B4+B27 CA to TS36.101	12.4.0
00 20	1 0.		1		
06-2014	RP-64	RP-140942	2213	Introduction of CA band combination B1+B20 to TS 36.101	12.4.0
06-2014	RP-64	RP-140917	2216	CR for EPDCCH test (Rel-12)	12.4.0
06-2014	RP-64	RP-140914	2218	CR of modification on FelCIC rank testing (Rel-12)	12.4.0
06-2014	RP-64	RP-140914	2220	CR on FeICIC PBCH performance requirement (Rel-12)	12.4.0
06-2014	RP-64	RP-140918	2222	Correction on out-of-band blocking for CA	12.4.0
06-2014	RP-64	RP-140918	2226	Update demodualtion performance requirements with new UE	12.4.0
00-2014	KF-04	KF-140916	2220	categories	12.4.0
06-2014	RP-64	RP-140911	2228	Correction for CA sustained data rate test (Rel-12)	12.4.0
06-2014	RP-64	RP-140911	2229	Correction on wrong annotation for close- loop spatial	12.4.0
00-2014	KF-04	KF-140945	2229	multiplexing performance	12.4.0
06-2014	RP-64	RP-140911	2233	Clarification of Intra-band contiguous CA class C Narrow band	12.4.0
06-2014	RP-04	KP-140911	2233		12.4.0
06-2014	RP-64	RP-140911	2239	blocking requirements Correction for CA soft buffer test (Rel-12)	12.4.0
06-2014	RP-64	RP-140911	2241	CR on OCNG and propagation conditions for dual layer TM9	12.4.0
06-2014	RP-64	RP-140918	2241		12.4.0
06 2014	RP-64	RP-140911	2247	test (Rel-12) Remove [] from elCIC TDD RI requirement	10.10
06-2014	_	_			12.4.0
06-2014	RP-64	RP-140914	2256	Verification of exceptions of REFSENS requirements for	12.4.0
00.0044	DD 04	DD 440044	0050	carrier aggregation	40.40
06-2014	RP-64	RP-140914	2258	Applicability of exceptions to reference sensitivity requirements for CA	12.4.0
00.0044	DD 04	DD 440000	0000		40.4.0
06-2014	RP-64	RP-140909	2269	In-band blocking case numbering re-establisment	12.4.0
06-2014	RP-64	RP-140918	2273	CR for TS36.101 FRC tables for COMP demodulation	12.4.0
06 204 4	DD 64	DD 440045	2277	requirements	12.4.0
06-2014	RP-64	RP-140945	2277	Editorial correction of note in clause 4.4	12.4.0
06-2014	RP-64	RP-140926	2282r	Editorial correction of note in clause 4.4	12.4.0
00.0011	DD o :	DD 446511	1 0000	Interduction of south 1999 1999 1999 1999	40.40
06-2014	RP-64	RP-140911	2283	Introduction of new bandwidth combination set for CA_1A-5A	12.4.0
00.55::	DE 6:	DD 445	10000	UE SP (() I' S P COMP COL S	10.15
06-2014	RP-64	RP-140914	2286	CR for finalizing DL COMP CSI reporting requirements	12.4.0
06-2014	RP-64	RP-140914	2288	CR for adding DL CoMP CSI RMC tables (Rel-12)	12.4.0
06-2014	RP-64	RP-140921	2291	Simplification of 36.101 Table 5.6A.1-1 for LTE_CA_C_B27	12.4.0
06-2014	RP-64	RP-140914	2293	Finalization of CoMP demodulation test cases	12.4.0
06-2014	RP-64	RP-140918	2294	Editorial corrections for UE performance requirements for R12	12.4.0
06-2014	RP-64	RP-140937	2295	Introduction of CA performance requirements for Band 27 CA	12.4.0
06-2014	RP-64	RP-140931	2296	Introduction of CA 1+11 to 36.101 (Rel-12)	12.4.0
06-2014	RP-64	RP-140994	2309	Inclusion of the out of band emission limit concluded in CEPT	12.4.0
	<u> </u>	<u> </u>		into band 28	
06-2014	RP-64	RP-140911	2314	UE to UE co-existence between B42/B43	12.4.0
00 2017	RP-64	RP-140911	2318	Perf: Corrections to CA (Class C) performance with power	12.4.0
06-2014		1	1 1 1	imbalance (Rel-12)	
06-2014	RP-64	RP-140920	2319		12.4.0
	RP-64	RP-140920 RP-140914	2319 2321	Introduction of CA performance requirements for Band 23 CA	12.4.0 12.4.0
06-2014 06-2014			2319 2321 2323		

06-2014	RP-64	RP-140911	2328	Clean-up CR for demodulation requirements (Rel-12)	12.4.0
06-2014	RP-64	RP-140945	2330r	Additional updates of UE categories for demodualtion	12.4.0
			1	performance requirements (Rel-12)	
06-2014	RP-64	RP-140911	2333	Throughput calculation for eICIC demodulation requirements	12.4.0
06-2014	RP-64	RP-140914	2335r 1	Introduction of Band 28 requirements for flexible operation in Japan	12.4.0
06-2014	RP-64	RP-140911	2337r	Add missing Uplink downlink configuration to elCIC TDD RI requirement	12.4.0
06-2014	RP-64	RP-140945	2338	Add static propagation condition matrix for 1 x 2	12.4.0
06-2014	RP-64	RP-140911	2341	Cleanup of terminology for Rx requirements	12.4.0
06-2014	RP-64	RP-140945	2344	CR on separating CA UE demodulation tests from single carrier tests in Rel-12	12.4.0
06-2014	RP-64	RP-140911	2351	Test configuration for intra-band contiguous carrier aggregation power control	12.4.0
06-2014	RP-64	RP-140935	2358	Addition of bandwidth combination sets for CA_2A-29A, CA_3A-5A, CA_4A-5A, CA_4A-12A, and CA_4A-29A into 36.101	12.4.0
06-2014	RP-64	RP-140914	2362	Correction of test configurations for intra-band non-contiguous aggregation	12.4.0
06-2014	RP-64	RP-140911	2365	Clarification on CA bandwidth classes	12.4.0
06-2014	RP-64	RP-140917	2374	CR on correction of downlink SDR tests with EPDCCH scheduling	12.4.0
06-2014	RP-64	RP-140922	2377	Correction on LTE_CA_C_B39	12.4.0
06-2014	RP-64	RP-140911	2378	Corrections on CA CQI tests	12.4.0
06-2014	RP-64	RP-140930	2381r 1	Introduction of LTE-Advanced CA of Band 8 and Band 40 to TS36.101	12.4.0
06-2014	RP-64	RP-140927	2382r 1	FRC for DL MIMO enahncement PMI requirements	12.4.0
06-2014	RP-64	RP-140603	2384r 2	CR for TS 36.101 on introduction CA_40D	12.4.0
06-2014	RP-64	RP-140944	2385r 1	CR to TS 36.101 on introduction of 3DL intra-band non- contiguous CA requirements	12.4.0
06-2014	RP-64	RP-140938	2387	Introduction of CA_2A-2A into TS 36.101	12.4.0
06-2014	RP-64	RP-140927	2392	Introduction of 4Tx beam steering model	12.4.0
06-2014	RP-64	RP-140914	2394	CA_7C A-MPR Corrections	12.4.0
06-2014	RP-64	RP-140936	2395r 2	Introduction of a new CA_7C bandwidth combination set into 36.101	12.4.0
06-2014	RP-64	RP-140918	2398	CR for TS36.101 CSI RMC table	12.4.0
06-2014	RP-64	RP-140940	2413	Introduction of LTE_CA_NC_B42 into 36.101	12.4.0
06-2014 06-2014	RP-64 RP-64	RP-140942 RP-140919	2420 2422	Introduction of CA band combination B1+B20 to TS 36.101 CA_3C is deleting 75RB+75RB uplink configuration for	12.4.0 12.4.0
06 2014	RP-64	DD 140014	2425	reference sensitivity CR on correction for TM10 CSI reporting requirements	10.40
06-2014 09-2014	RP-65	RP-140914 RP-141197	2425 2458r	Introduction of CA_B1_B3_B19 into TS 36.101	12.4.0 12.5.0
09-2014	RP-65	RP-141428	2568	Updated REFSENS requirements for band combinations with Band 4 and Band 12	12.5.0
09-2014	RP-65	RP-141468	2508r	Introduction of 3 DL CA for Band 1+3+20	12.5.0
09-2014	RP-65	RP-141469	2571	Correction to CA in Band 1+20	12.5.0
09-2014	RP-65	RP-141525	2504r	Perf: Cleanup and better description of DL-RMC-s with dynamic coding rate for CSI requirements (Rel-12)	12.5.0
09-2014	RP-65	RP-141525	2565	Corrections to UE coex table	12.5.0
09-2014	RP-65	RP-141527	2434	Correction on support of a bandwidth combination set	12.5.0
09-2014	RP-65	RP-141527	2452r 1	Remove the redundant table for FDD 4Tx multi-layer tests and correct the test case number (Rel-12)	12.5.0
09-2014	RP-65	RP-141527	2466	Unequal DL CC RB allocations in Maximum input level	12.5.0
09-2014	RP-65	RP-141527	2469	Intra-band contiguous CA ACS case 2 test clarification	12.5.0
09-2014	RP-65	RP-141527	2484	Corrections on delta Tc for UE MOP for intra-band contiguous CA	12.5.0
09-2014	RP-65	RP-141527	2487	Removal of Class B in UE TX requirement	12.5.0
09-2014	RP-65	RP-141527	2516r 1	CR for CA applicability rule in 36.101 in Rel-12	12.5.0
09-2014	RP-65	RP-141527	2519r 1	Editorial CR for CA performance tests in 36.101 in Rel-12	12.5.0
00 2014		RP-141527	2548	Correction to NS_20 A-MPR for Band 23	12.5.0
09-2014	RP-65		1	CR of introducing FelCIC TM9 testing (Rel-12)	12.5.0
	RP-65 RP-65 RP-65	RP-141530 RP-141530	2447 2454	Maintenance of CoMP demodulation performance	12.5.0
09-2014 09-2014 09-2014	RP-65 RP-65	RP-141530 RP-141530	2454	Maintenance of CoMP demodulation performance requirements (Rel-12)	12.5.0
09-2014 09-2014 09-2014	RP-65 RP-65	RP-141530 RP-141530 RP-141530	2454 2456	Maintenance of CoMP demodulation performance requirements (Rel-12) Clean-up CR for EPDCCH and FelCIC PBCH (Rel-12)	12.5.0 12.5.0
09-2014 09-2014 09-2014	RP-65 RP-65	RP-141530 RP-141530	2454	Maintenance of CoMP demodulation performance requirements (Rel-12)	12.5.0

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		DD 111500	2444	subframe sets with CRS tests (Rel-12)	10-0
09-2014	RP-65	RP-141532	2444	Clarification of high speed train scenario in 36.101 (Rel-12)	12.5.0
09-2014	RP-65	RP-141532	2478	CQI reporting under fading: CQI indices in set	12.5.0
09-2014 09-2014	RP-65 RP-65	RP-141532 RP-141532	2490 2499	Correction on A-MPR table RF: Corrections to spurious emission band co-existence	12.5.0 12.5.0
				requirement for Band 44	
09-2014	RP-65	RP-141535	2559	Addition of E-UTRA CA configurations and bandwidth combination sets defined for inter-band CA for Band 4 and 27	12.5.0
09-2014	RP-65	RP-141537	2541	Band 42 contiguous CA channel bandwidth correction	12.5.0
09-2014	RP-65	RP-141546	2463r	Introduction of PMI reporting requirements for DL MIMO	12.5.0
			1	enhancement	
09-2014	RP-65	RP-141548	2457r 2	Introduction of CA_B1_B3 into TS 36.101	12.5.0
09-2014	RP-65	RP-141549	2556	Addition of bandwidth combination set for CA_2A-4A	12.5.0
09-2014	RP-65	RP-141550	2566	Addition of 3MHz bandwidth for Band 12, in the B2+B12 CA	12.5.0
				combination	
09-2014	RP-65	RP-141551	2445	Introduction of CA 8+11 to 36.101 (Rel-12)	12.5.0
09-2014	RP-65	RP-141553	2491r	Introduction of a new bandwidth combination set for CA_25A-	12.5.0
			1	25A into 36.101	
09-2014	RP-65	RP-141554	2533r 1	Introduction of requirements for 3DL inter-band carrier aggregation (FDD)	12.5.0
09-2014	RP-65	RP-141554	2534	Introduction of requirements for 3DL combinations with Band 30 (FDD)	12.5.0
09-2014	RP-65	RP-141557	2461r	Introduction of CA_B19_B42_B42 into TS 36.101	12.5.0
09-2014	RP-65	RP-141559	1 2460r	Introduction of CA_B1_B42_B42 into TS 36.101	12.5.0
			1		
09-2014	RP-65	RP-141560	2427	Adding 15MHz channel BW to B40 3DL and new bandwidth combination set for the 2DL	12.5.0
09-2014	RP-65	RP-141561	2488r 1	Corrections on Maximum input level for intra-band non- contiguous 3DL	12.5.0
09-2014	RP-65	RP-141562	2436	Corrections on Maximum input level and ACS for intra-band CA	12.5.0
09-2014	RP-65	RP-141562	2481r 1	Introduction of CA band combination B41+ B42 to TS 36.101	12.5.0
09-2014	RP-65	RP-141562	2522	CR on CA power imbalance tests in Rel-12	12.5.0
09-2014	RP-65	RP-141562	2560	CR Reducing MPR for Contiguous CA with Non-Contiguous	12.5.0
				Resource Allocations	
09-2014	RP-65	RP-141563	2555r 1	UL configuration for CA_4A-12A reference sensitivity	12.5.0
09-2014	RP-65	RP-141563	2557	Addition of bandwidth combination set for CA_4A-12A	12.5.0
09-2014	RP-65	RP-141612	2494r 2	Introduction of inter-band CA_18-28 into TS36.101	12.5.0
09-2014	RP-65	RP-141635	2552r 2	Introduction of CA_1A-7A into 36.101(Rel-12)	12.5.0
09-2014	RP-65	RP-141636	2480r	Introduction of 3DLs CA band combination of Band1 +5 + 7 to	12.5.0
09-2014	RP-65	RP-141653	2435r	TS 36.101 Rel-12 Introduction of 3 Band Carrier Aggregation (3DL/1UL) of Band	12.5.0
09-2014	RP-65	RP-141682	3 2570r	1, Band 3 and Band 8 to TS 36.101 Introduction of CA band combination B1+B7+B20 to TS	12.5.0
			1	36.101	
09-2014	RP-65	RP-141708	2492r 3	Introduction of 3 Band Carrier Aggregation of Band 1,Band 3 and Band 5 to TS 36.101	12.5.0
12-2014	RP-66	RP-142147	2671	Correction of CoMP TDD CSI tests (Rel-12)	12.6.0
12-2014	RP-66	RP-142144	2574	CR for REFSENSE in lower SNR and change history	12.6.0
12-2014	RP-66	RP-142173	2581	CR on 4Tx codebook PMI testing	12.6.0
12-2014	RP-66	RP-142142	2587	CR for 1 PRB allocation performance in presence of MBSFN (rel-12)	12.6.0
12-2014	RP-66	RP-142144	2590	Maintenance of CA demodulation performance requirements (Rel-12)	12.6.0
12-2014	RP-66	RP-142147	2592	Clean up for FelCIC demodulation performance requirements (Rel-12)	12.6.0
12-2014	RP-66	RP-142166	2600	Correction of placement of CA_40D in Table	12.6.0
12-2014	RP-66	RP-142162	2601	CQI test for TDD CL_C 20MHz+15MHz in Rel-12	12.6.0
12-2014	RP-66	RP-142162	2602	Sustained downlink data rate test for TDD CL_C 20MHz+15MHz in Rel-12	12.6.0
12-2014	RP-66	RP-142165	2611	Removal of square brackets for CA_B1_B3 and CA_B1_B3_B19	12.6.0
12-2014	RP-66	RP-142147	2620	CQI reporting in AWGN: CQI indices in set	12.6.0
12-2014	RP-66	RP-142147	2629	CR to fix error of CA capability for CA performance tests in 36.101 in Rel-12	12.6.0
12-2014	RP-66	RP-142144	2637	Definition of the bits in the bitmap for indication of modified	12.6.0
12-2014	RP-66	RP-142147	2641	MPR behavior Applicability of in-gap and out-of-gap measurements for intra-	12.6.0
				band NC CA	

12-2014	RP-66	RP-142183	2642	Introduction of additional bandwidth combination set for CA_2A-5A	12.6.0
12-2014	RP-66	RP-142164	2643	Corrections for 3DL inter-band CA band combinations	12.6.0
12-2014	RP-66	RP-142147	2661	Maintenance of TM10 demodulation test configurations on PQI set and ZP-CSIRS (Rel-12 test 8.3.1.3.2, 8.3.2.4.2)	12.6.0
12-2014	RP-66	RP-142173	2582r 1	Introduction of PUSCH 3-2 requirements into TS36.101	12.6.0
12-2014	RP-66	RP-142162	2603r 1	Normal demodulation test for TDD CL_C 20MHz+15MHz in Rel-12	12.6.0
12-2014	RP-66	RP-142164	2576r 1	Corrections on Out-of-band blocking requirements for CA Class B and D	12.6.0
12-2014	RP-66	RP-142149	2678	CR to specify applicability of CoMP RI test (Rel-12)	12.6.0
12-2014	RP-66	RP-142144	2688	Removal of bracket for UL MIMO	12.6.0
12-2014	RP-66	RP-142164	2689	Corection of B29 REFSENS for CA_2A-29A-30A and CA_4A-29A-30A	12.6.0
12-2014	RP-66	RP-142144	2700	Delete the incorrect notes for FDD DMRS demodulation tests (Rel-12)	12.6.0
12-2014	RP-66	RP-142160	2594r 3	Correcting requirements for inter-band CA_18-28 in TS36.101	12.6.0
12-2014	RP-66	RP-142173	2705	CR of modification on PMI reporting requirements for DL MIMO enhancement	12.6.0
12-2014	RP-66	RP-142144	2720	Band 22 correction in UE to UE co-existance table.	12.6.0
12-2014	RP-66	RP-142147	2722	Correction to non-contiguous downlink intraband CA receiver requirements	12.6.0
12-2014	RP-66	RP-142159	2752	Removal of dRib from CA_1A-7A	12.6.0
12-2014	RP-66	RP-142147	2723	Correction to table format of allowed channel bandwidths of non-contiguous intraband CA	12.6.0
12-2014	RP-66	RP-142164	2643r 1	Corrections for 3DL inter-band CA band combinations	12.6.0
12-2014	RP-66	RP-142146	2731	Modifications for NS_12 and NS_13	12.6.0
12-2014	RP-66	RP-142189	2739	Introduction of CA_5-13 into 36.101	12.6.0
12-2014	RP-66	RP-142173	2706r 1	CR of reference measurement channel for PUSCH3-2 test	12.6.0
12-2014	RP-66	RP-142144	2727r 1	CR for CA applicability rule in 36.101 in Rel-12	12.6.0
12-2014	RP-66	RP-142188	2676r 1	CR to remove CA capability column in CA performance test tables (Rel-12)	12.6.0
12-2014	RP-66	RP-142173	r3	Introduction of PUSCH 3-2 requirements into TS36.101	12.6.0
12-2014	RP-66	RP-142187	2690r 1	CR on sustained data rate test for 3DL CA	12.6.0
12-2014	RP-66	RP-142187	2681r 2	CR on normal demodulation test for 3DL CA	12.6.0
12-2014	RP-66	RP-142147	2747r 1	TS36.101 removal of brackets (RF)	12.6.0
12-2014	RP-66	RP-142144	2755	Correction to Transmit Modulation Quality for CA	12.6.0
12-2014	RP-66	RP-142144	2710r 1	Clarification on UL and DL CA	12.6.0
12-2014	RP-66	RP-142144	2717r 1	Clarification of notes relating to interferer offsets in intraband CA receiver requirement tables.	12.6.0
12-2014	RP-66	RP-142147	2735r 1	Band 28 and NS_24	12.6.0
12-2014	RP-66	RP-142179	2684r 1	CR for UE requirements for 256QAM	12.6.0
12-2014	RP-66	RP-142180	2729r 1	Introduction of Dual Connectivity to TS 36.101 Rel-12, RF part	12.6.0
12-2014	RP-66	RP-142184	2680r 1	Introduction of dual uplink inter-band CA in TS 36.101 rel-12	12.6.0
12-2014	RP-66	RP-142182	2701r 1	Introduction of inter-band CA_1-28 into TS36.101	12.6.0
12-2014	RP-66	RP-142144	2758	Correction to Note 2 of Harmonic Signal Exceptions in Spurious Emissions	12.6.0
12-2014	RP-66	RP-142144	2751r 2	Removal of brackets and TBD from CA feature	12.6.0
12-2014	RP-66	RP-142144	2697r 1	Maintenance of CA performance requirements (Rel-12)	12.6.0
12-2014	RP-66	RP-142187	2679r 2	CR to introduce CQI test for 3 DL CA	12.6.0
12-2014	RP-66	RP-142185	2721r	Addition of 2UL non-contiguous intraband CA feature	12.6.0
12-2014	RP-66	RP-142144	2704r 2	UE to UE co-existence between B42/B43	12.6.0
12-2014	RP-66	RP-142176	2685r 2	Introduction of LC MTC into TS 36.101	12.6.0
12-2014	RP-66	RP-142190	2759r	Introduction of additional band combinations for 3DL interband CA	12.6.0
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03-2015	RP-67	RP-150387	2760r 2	Introduce additional bands of LC MTC	12.7.0
03-2015	RP-67	RP-150387	2761	CR on corrections to Dual-Layer Spatial Multiplexing with multiple CSI-RS config Rel-12	12.7.0
03-2015	RP-67	RP-150392	2765r 1	CR for applicability and test rules for TDD-FDD CA performance requirements	12.7.0
03-2015	RP-67	RP-150392	2766	Introduction of CQI tests for TDD-FDD CA	12.7.0
03-2015	RP-67	RP-150395	2767r	CR to introduce the SU-MIMO whitening verification test	12.7.0
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03-2015	RP-67	RP-150392	2768r 1	CR on power imbalance test for 3DL CA	12.7.0
03-2015	RP-67	RP-150392	2769	CR on sustained data rate test for TDD FDD CA	12.7.0
03-2015	RP-67	RP-150394	2770r	CR for introduction of 256QAM demodulation performance	12.7.0
03-2015	RP-67	RP-150393	2772r	requirements CR: DC UE performance requirements	12.7.0
03-2015	RP-67	RP-150390	1 2773r	CR: MTC demodulation performance requirements	12.7.0
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03-2015	RP-67	RP-150390	2774r 1	CR: MTC CSI requirements	12.7.0
03-2015	RP-67	RP-150396	2775r 1	Introduction of the eIMTA functional PDSCH demodulation test	12.7.0
03-2015	RP-67	RP-150387	2776r 3	CR on RF core requirements for D2D	12.7.0
03-2015	RP-67	RP-150387	2777	Modification of CSI reference measurement channel Rel-12	12.7.0
03-2015	RP-67	RP-150388	2779	Editorial correction for CA_18A-28A	12.7.0
03-2015	RP-67	RP-150388	2781	Removing brackets for CA_1A-28A MSD requirements	12.7.0
03-2015	RP-67	RP-150384	2783	Editorial correction on symbols for enhanced performance requirements type A	12.7.0
03-2015	RP-67	RP-150387	2784	Corrections on reference measurement channel	12.7.0
03-2015	RP-67	RP-150388	2792	Correction of TS 36.101 for the Pcell support of 25+41	12.7.0
03-2015	RP-67	RP-150395	2793r	CR for single cell demodulation test for SU-MIMO	12.7.0
03-2015	RP-67	RP-150391	2794	Introduction of CA_3A-42A and CA_3A-42C into 36.101	12.7.0
03-2015	RP-67	RP-150384	2797	UL HARQ in PDSCH and PDCCH/PCFICH demod test cases for elCIC/felCIC with MBSFN ABS	12.7.0
03-2015	RP-67	RP-150382	2800	Correction to eICIC aggressor cell configurations	12.7.0
03-2015	RP-67	RP-150387	2801	R4-73AH-0040: Correction for uplik CA configuration in TS 36.101 Rel-12	12.7.0
03-2015	RP-67	RP-150387	2802r	Correction of MSD levels for CA_1A-8A in TS 36.101 rel-12	12.7.0
03-2015	RP-67	RP-150387	2805	Removal of eDL-MIMO term from specification	12.7.0
03-2015	RP-67	RP-150388	2809	Clarification of 2UL/3DL contiguous intraband CA REFSENS	12.7.0
03-2015	RP-67	RP-150392	2811r	CR on TM4 normal demodulation test for 3DL CA	12.7.0
03-2015	RP-67	RP-150392	2812	CR on introducing new DL referece measurement channels	12.7.0
03-2015	RP-67	RP-150392	2813r	CR on normal demodulation test for TDD-FDD CA	12.7.0
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03-2015	RP-67	RP-150388	2815	Additions of bandwidth combination set reference	12.7.0
03-2015	RP-67	RP-150388	2816	Correction of band number in Table 5.6A.1-2a for LTE_CA_B4_B12_B30	12.7.0
03-2015	RP-67	RP-150382	2819	UE to UE co-existence between B42/B43	12.7.0
03-2015	RP-67	RP-150382	2822	Corrections to CA in-band emissions requirement	12.7.0
03-2015	RP-67	RP-150381	2830	Uplink RMCs for sustained data rate test	12.7.0
03-2015	RP-67	RP-150382	2833	Corrections to the CA power imbalance test	12.7.0
03-2015	RP-67	RP-150392	2839r	CR for soft buffer tests for TDD-FDD CA in 36.101 in Rel-12	12.7.0
03-2015	RP-67	RP-150392	2842	Editorial CR for CA UE performance tests in 36.101 in Rel-12	12.7.0
03-2015	RP-67	RP-150387	2847	UE spurious emissions structure correction for CA	12.7.0
03-2015	RP-67	RP-150387	2850	Correction of PCMAX for uplink inter-band and intra-band carrier aggregation	12.7.0
03-2015	RP-67	RP-150387	2851	Exceptions for spurious response for UL CA	12.7.0
03-2015	RP-67	RP-150388	2852r	Correction of REFSENS, OOBB and uplink configuration for	12.7.0
02 2045	RP-67	DD 450200	2853	3DL/1UL CA SNR definition for category 0 UE	12.7.0
03-2015 03-2015	RP-67	RP-150390 RP-150390	2854r	FRC for category 0 UE PDSCH performance requirements	12.7.0
03-2015	RP-67	RP-150390	1 2855r	Introduction of new PHICH and PBCH performance	12.7.0
03-2015		RP-150387	1	requirements for category 0 UE Correction to FOOB reference in definition of MPR for	12.7.0
	RP-67		2861	contiguous CA with non-contiguous resource allocation	
03-2015	RP-67	RP-150387	2862	Band 31 update	12.7.0
03-2015	RP-67	RP-150384	2867	Implementation of CA configurations specified in later releases	12.7.0

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06-2015	RP-68	RP-150958	2870r 2	Intra-band contiguous CA reference sensitivity definition for Class D	12.8.0
06-2015	RP-68	RP-150961	2881r 2	CR on MTC CQI tests	12.8.0
06-2015	RP-68	RP-150962	2882r 2	CR on 256QAM demodulation performance requirements	12.8.0
06-2015	RP-68	RP-150962	2883r 3	CR on 256QAM sustained data rate tests for single carrier and TDD or FDD CA	12.8.0
06-2015	RP-68	RP-150962	2885r 4	CR on 256QAM CQI test	12.8.0
06-2015	RP-68	RP-150963	2886r	CR on DC SDR tests	12.8.0
06-2015	RP-68	RP-150963	3 2887r 2	Maintenance CR for DC demodualtion performance requirements	12.8.0
06-2015	RP-68	RP-150958	2888	CR to restore R.10-2 FDD	12.8.0
06-2015	RP-68	RP-150961	2889r	Introduction of UE category 0 PDSCH/PHICH/PBCH	12.8.0
			3	performance requirements	
06-2015	RP-68	RP-150954	2901	UE to UE co-existence between B42/B43	12.8.0
06-2015	RP-68	RP-150958	2902	Correction of maximum aggregated bandwidth for CA_26A-41A	12.8.0
06-2015	RP-68	RP-150957	2903r 2	Introduction of TDD SU-MIMO whitening verification test	12.8.0
06-2015	RP-68	RP-150958	2904	Correction of FRC table for CA demodualtion with power imbalance	12.8.0
06-2015	RP-68	RP-150958	2905r 1	Add SCell power levels for 2DL CA power imbalance test	12.8.0
06-2015	RP-68	RP-150955	2907	Corrections on UL transmit power for CA receiver requirements	12.8.0
06-2015	RP-68	RP-150958	2909	Corrections to the CA power imbalance test	12.8.0
06-2015	RP-68	RP-150957	2910r 1	Clarification on RMC for D2D UE	12.8.0
06-2015	RP-68	RP-150960	2911	Correction on TDD eIMTA PDSCH functionality test	12.8.0
06-2015	RP-68	RP-150954	2931	3.5 GHz out-of-band blocking	12.8.0
06-2015	RP-68	RP-150965	2933	Correction of FRC names	12.8.0
06-2015	RP-68	RP-150954	2936	Correction of the 3DL CA REFSENS	12.8.0
06-2015	RP-68	RP-150962	2939r	CR on 256QAM sustained data rate tests for TDD FDD CA	12.8.0
06-2015	RP-68	RP-150958	2940r 1	Maintenance CR for 3DL CA performance requirements	12.8.0
06-2015	RP-68	RP-150958	2941r 1	Maintenance CR for TDD FDD CA demodulation performance requirements	12.8.0
06-2015	RP-68	RP-150965	2944	Corrections on 2UL intra-band non-contiguous CA requirements	12.8.0
06-2015	RP-68	RP-150958	2947	Updates to the definitions of CA capability (Rel-12)	12.8.0
06-2015	RP-68	RP-150955	2950	Clarification of PDSCH allocation in CSI PUSCH 3-0 felCIC	12.8.0
06-2015	RP-68	RP-150954	2956	tests (Rel-12) NS value for intra-band contiguous CA configurations not	12.8.0
06-2015	RP-68	RP-150957	2958	allowed A-MPR Receiver spurious emissions requirements for downlink-only	12.8.0
06-2015	RP-68	RP-150958	2959	bands Amendments to MPR for uplink inter-band and intra-band non-	12.8.0
06-2015	RP-68	RP-150958	2960r	contiguous CA NS values for secondary cells of non-contigous CA	12.8.0
06-2015	RP-68	RP-150955	1 2961r	configurations Corrections to test configurations for intra-band non-	12.8.0
			1	contiguous CA	
06-2015	RP-68	RP-150954	2962	Corrections to test configurations for 3DL inter-band CA	12.8.0
06-2015	RP-68	RP-150958	2967	Adding REFSENS exception requirements for 1+3+26	12.8.0
06-2015	RP-68	RP-150954	2971	Corrections to NS_22 and NS_23	12.8.0
06-2015	RP-68	RP-150958	2972	Corrections to 41D fallback	12.8.0
06-2015	RP-68	RP-150957	2972	Corrections to EVM requirements for ProSe and Annex F of 36.101	12.8.0
06-2015	RP-68	RP-150958	2976	Removal of B27 from 2UL CA_7A_20A co-existence protected band list	12.8.0
06-2015	RP-68	RP-150957	2977r 1	CR on corrections to D2D RF core requirements	12.8.0
06-2015	RP-68	RP-150963	2978r 1	CR on corrections to D2D RF core requirements	12.8.0
06-2015	RP-68	RP-150957	2979	CR clarification of RMC for DL category 0 UE HD-FDD	12.8.0
06-2015	RP-68	RP-150960	2980r 1	Introducation of TDD elMTA CQI requirement	12.8.0
06-2015	RP-68	RP-150958	2985	Change of 1.4MHz single carrier SNR values for multiple CA	12.8.0
06-2015	RP-68	RP-150954	2992	configurations Clarification to spurious emission requirement for the edge of	12.8.0
<u> </u>				spurious domain	

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06-2015	RP-68	RP-150955	2996	Correction to CA_7C A-MPR in CA-NS_06	12.8.0
06-2015	RP-68	RP-150965	2998r 1	CR to update UE performance tests for UE DL category in 36.101 in Rel-12	12.8.0
06-2015	RP-68	RP-150965	2999	CR to update Annex for new DL category in 36.101 in Rel-12	12.8.0
06-2015	RP-68	RP-150958	3002	CR for updating CA applicability rule in 36.101 in Rel-12	12.8.0
06-2015	RP-68	RP-150957	3005r	CR for Rel-12 NAICS - Definitions	12.8.0
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06-2015	RP-68	RP-150965	3012r 1	Clarification on uplink configuration for reference sensitivity of inter-band CA	12.8.0
06-2015	RP-68	RP-150954	3018	EVM for Intra-band contiguous UL CA for non-equal Channel BWs	12.8.0
06-2015	RP-68	RP-150958	3019	A-MPR correction for CA_39C CA_NS_07	12.8.0
06-2015	RP-68	RP-150958	2780r	Introduction of dual uplink CA into 36.101	13.0.0
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06-2015	RP-68	RP-150646	2785r 2	Introduction of intra-band CA_42D to TS 36.101	13.0.0
06-2015	RP-68	RP-150968	2951r 2	Introduction of additional 2DL inter-band CA	13.0.0
06-2015	RP-68	RP-150972	2952r 1	Introduction of additional 3DL inter-band CA	13.0.0
06-2015	RP-68	RP-150974	2953r	Introduction of 4DL inter-band CA	13.0.0
06-2015	RP-68	RP-150975	2 2994r	Introduction of non-contiguous Carrier Aggregation (CA) in	13.0.0
			1	Band 42 for 3DL	
06-2015	RP-68	RP-150967	3011r 1	CR to 36.101: New CA bandwidth classes for FeCA	13.0.0
06-2015	RP-68	RP-150668	3021	Introduction of CA_3A-40A to TS 36.101	13.0.0
06-2015	RP-68	RP-150673	3022	Introduction of CA_3A-40C to TS 36.101	13.0.0
09-2015	RP-69	RP-151479	3028	Table 7.3.1A-0f (2UL CA MSD) notes numbering correction	13.1.0
09-2015	RP-69	RP-151505	3029	Additional bandwidth combination set for LTE Advanced intra-	13.1.0
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09-2015	RP-69	RP-151479	3031	Correction to TDD FDD CA	13.1.0
09-2015	RP-69	RP-151483	3033	Alignment of CA Receiver requirements parameters	13.1.0
09-2015	RP-69	RP-151476	3036	Correction to CoMP demodulation requirements	13.1.0
09-2015	RP-69	RP-151475	3040	Correction to RI test parameters in TS 36.101 (Rel-13)	13.1.0
09-2015	RP-69	RP-151475	3050	UE co-existence requirements between Band 42 and Japanese bands	13.1.0
09-2015	RP-69	RP-151483	3052	Introduction of relaxation rule for multiple 3DL inter-band CA	13.1.0
09-2015	RP-69	RP-151491	3056r	configurations Adding CA_42D to the out of band blocking requirement	13.1.0
09-2015	RP-69	RP-151501	1 3057r	exception Introduction of finished 4DL inter-band CAs to TS 36.101	13.1.0
09-2015	RP-69	RP-151487	1 3060r	Corrections on CA reference sensitivity requirements	13.1.0
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09-2015	RP-69	RP-151476	3064	Correction to RC.2 TDD Nr. HARQ Proc. into TS36.101	13.1.0
09-2015	RP-69	RP-151483	3065	Corrections to CSI PUCCH 1-0 static test 4 and PUSCH 3-2	13.1.0
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09-2015	RP-69	RP-151488	3066	Corrections in Table 5.6A.1-2, 7.3.1-1A and 7.3.1-1B.	13.1.0
09-2015	RP-69	RP-151479	3068	Corrections of Spurious emission band UE co-existence for	13.1.0
00.0045	DD CO	DD 454400	2070	interband 2UL CA in Table 6.6.3.2A-0 Revisions of Spurious emission band UE co-existence in	40.4.0
09-2015	RP-69	RP-151483	3070	Table 6.6.3.2-1	13.1.0
09-2015	RP-69	RP-151475	3076	Correction to PDCCH/PCFICH test parameters in TS 36.101 (Rel-13)	13.1.0
09-2015	RP-69	RP-151475	3080	Correction to PMI delay in PMI test for TDD	13.1.0
09-2015	RP-69	RP-151503	3081r	Introduction of dual uplink CA into 36.101	13.1.0
09-2015	RP-69	RP-151479	3083	Maintanence CR for MTC CSI performance requirements	13.1.0
09-2015	RP-69	RP-151479	3085	Maintanence CR for MTC CSI performance requirements Maintanence CR for SCE demodulation and CSI requirements	13.1.0
09-2015	RP-69	RP-151479	3087	Maintenance CR for DC demodulation performance	13.1.0
09-2015	RP-69	RP-151479	3089	requirements and SDR tests Cleanup of TDD-FDD CA demodulation performance	13.1.0
09-2015	RP-69	RP-151479	3091	requirments Cleanup of R12 SU-MIMO Enhanced Performance Type C	13.1.0
09-2015	RP-69	RP-151475	3102	requirments Correction on UE maximum output power class of Band 22 for	13.1.0
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09-2015	RP-69	RP-151479	3104	Removal of square brackets for Cat-0 UE demodulation requirements	13.1.0
09-2015	RP-69	RP-151479	3106	Removal of square brackets for LTE-CA_B41_B42	13.1.0
09-2015	RP-69	RP-151490	3107	Removal of square brackets for LTE-CA_B41_B42_B42	13.1.0
09-2015	RP-69	RP-151479	3112	Corrections on 3DL CA performance requirements	13.1.0
09-2015	RP-69	RP-151489	3113	CR 36.101 BW combination for CA_8A_41A	13.1.0
09-2015	RP-69	RP-151479	3114	UL DL pairing for CA of B39+B41+B41 and B39+B39+B41	13.1.0

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09-2015	RP-69	RP-151498	3116	Introduction of additional band combinations for 2DL interband CA	13.1.0
09-2015	RP-69	RP-151499	3117	Introduction of additional band combinations for 3DL interband CA	13.1.0
09-2015	RP-69	RP-151475	3118	Minor corrections in 36.101	13.1.0
09-2015	RP-69	RP-151479	3121	CR adding clarification for Band 28 restrictions in 36.101	13.1.0
09-2015	RP-69	RP-151494	3123r 1	Introduction of propagation conditions to handle 4 receivers in the UE	13.1.0
09-2015	RP-69	RP-151504	3125r 1	Addition on interband CA 2UL/3DL pairs without MSD	13.1.0
09-2015	RP-69	RP-151483	3127	CR for UE performance tests for intra-band contiguous CA with minimum channel spacing on Band 41	13.1.0
09-2015	RP-69	RP-151496	3130r 2	TM9 performance with CRS assistance information	13.1.0
09-2015	RP-69	RP-151495	3133r 1	Introduction of UL 64QAM to TS 36.101	13.1.0
09-2015	RP-69	RP-151483	3135r 1	Modification of test parameters for TM9 demodulation with 256QAM (Rel-13)	13.1.0
09-2015	RP-69	RP-151485	3137	CR to add demodulation tests for new release 13 2CC combinations in 36.101	13.1.0
09-2015	RP-69	RP-151501	3139r 1	Introduction of 4CC demodulation requirements for FDD and FDD-TDD CA	13.1.0
09-2015	RP-69	RP-151479	3141	Correction to FDD-TDD closed loop spatial multiplexing 3CC requirement table	13.1.0
09-2015	RP-69	RP-151473	3143r 1	Correction to DC supported testable bandwidth list	13.1.0
09-2015	RP-69	RP-151479	3145	Clarification of UL configuration for CA demodulation requirements	13.1.0
09-2015	RP-69	RP-151479	3146r 1	Spreading of harmonic for 2UL interband and 2 ULnon- contiguous intraband CA	13.1.0
09-2015	RP-69	RP-151502	3147	Correction to dRib and REFSENS	13.1.0
09-2015	RP-69	RP-151479	3153	Corrections to CSI RMCs used for PUSCH 3-2 testing (Rel-13)	13.1.0
09-2015	RP-69	RP-151483	3155	Corrections to applicability of CSI requirements for low UE categories (Rel-13)	13.1.0
09-2015	RP-69	RP-151482	3164	CR for Rel-12 NAICS - Demodulation Test	13.1.0
09-2015	RP-69	RP-151482	3165	CR for Rel-12 NAICS - Fixed Reference Channels	13.1.0
09-2015	RP-69	RP-151482	3166	CR for Rel-12 NAICS - Interference Models	13.1.0
09-2015	RP-69	RP-151482	3167	CR for Rel-12 NAICS - CQI Tests	13.1.0
09-2015	RP-69	RP-151205	3168	Introduction of CA_7A-40A and CA_7A-40C to TS 36.101	13.1.0
09-2015 12-2015	RP-69 RP-70	RP-151593 RP-152158	3170 3172r 1	CR for Rel-13 NAICS – TM10 Demodulation and CSI Test Introduction of UE RF requriements for CA_42E	13.1.0 13.2.0
12-2015	RP-70	RP-152137	3173	Correction on UL 64QAM measurment channels	13.2.0
12-2015	RP-70	RP-152131	3175	Release 13 CAT A CR to align NS_04 values to meet FCC OOBE requirements	13.2.0
12-2015	RP-70	RP-152136	3178	Maintenance of eIMTA PDSCH demodulation test	13.2.0
12-2015	RP-70	RP-152136	3180r	Correction for eIMTA CQI tests	13.2.0
12-2015	RP-70	RP-152133	3186	Simplified CA fading Test method becomes optional	13.2.0
12-2015	RP-70	RP-152133	3191	Correction of the applicable UE categories for 256QAM UE	13.2.0
12-2015	RP-70	RP-152133	3193r	demodulation performance requirements (Rel-13) Correction of TDD-FDD CA performance requirements (Rel-	13.2.0
12-2015	RP-70	RP-152133	1 3195r	Correction on FDD CA and TDD CA performance	13.2.0
12-2015	RP-70	RP-152163	3196	requirements (Rel-13) CR on introduction of 5CC FDD/TDD CA demodulation	13.2.0
12-2015	RP-70	RP-152163	3197	performance requirements CR on introduction of 5CC TDD FDD CA demodulation	13.2.0
12-2015	RP-70	RP-152132	3205	performance requirements Correction of the AMPR table for NS_14 in TS 36.101 R13	13.2.0
12-2015	RP-70	RP-152134	3206	Correction of the 2UL CA co-existence table for CA_18A-28A	13.2.0
12-2015	RP-70	RP-152152	3209	Introduction of 3DL/2UL DC	13.2.0
12-2015	RP-70	RP-152139	3210r 1	Correction of uplink configuration for CA_42D	13.2.0
12-2015	RP-70	RP-152133	3212	Introduction of dual uplink CA into 36.101	13.2.0
12-2015	RP-70	RP-152133	3214	Corrections to the CSI minimum requirement for PUSCH 3-2 (Rel-13)	13.2.0
12-2015	RP-70	RP-152133	3216	Corrections to MIMO Correlation Matrices using cross polarized antennas (Rel-12)	13.2.0
12-2015	RP-70	RP-152157	3221r 1	Introducing B20 + B67 CA into TS 36.101	13.2.0
12-2015	RP-70	RP-152136	3225	CR for UE performance tests for intra-band contiguous CA	13.2.0
12-2015	RP-70	RP-152136	3227r	with minimum channel spacing on Band 41 Correction in SNR definition for CSI test	13.2.0
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12-2015	RP-70	RP-152130	3232	Correction to reference channel for CQI requirements	13.2.0
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12-2015	RP-70	RP-152136	3276	Clarification on relative power tolereance for CA	13.2.0
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12-2015	RP-70	RP-152135	3281	CR to finalize demodulation performance requirements for	13.2.0
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12-2015	RP-70	RP-152167	3286r	Introduction of CA_5B to TS 36.101	13.2.0
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12-2015	KF-70	KF-152150	1	CK on ebzb KF core requirements	13.2.0
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12-2015	RP-70	RP-152171	3		10.2.0
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12 2010	1 70	141 102101	1	assistance information is provided for multiple-CSI-process	10.2.0
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40.0045	DD 70	DD 450400	0005	capable UE	10.00
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40.0045	DD 70	DD 450400	2220	Rel-13	40.00
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12-2015	RP-70	RP-152131	3343	Table 6.2.4A-1 note 1 correction	13.2.0
12-2015	RP-70	RP-152164	3345	Removal of (NOTE 4) from Table 5.6A.1-2a	13.2.0
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03/2016	RP-71	RP-160489	3402	<u> </u>	A	[Rel-13] NS_05 modification for PHS protection in Japan	13.3.0
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03/2016	RP-71	RP-160489	3456	<u> </u>	A	Maintenance CR for D2D (Rel-13)	13.3.0
03/2016	RP-71	RP-160489	3458 3482	+	A	CR: Correction of FRC for SDR test (Rel-13)	13.3.0
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06/2016	RP-72	RP-161136	3592	2	В	CR on Definitions for DL control channel IM	13.4.0
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09/2016	RP-73	RP-161640	3798	<u> </u>	Α	Correction of OCNG	13.5.0
09/2016	RP-73	RP-161640	3803		F	CR: Correction of power parameter for demodulation tests	13.5.0
09/2016	RP-73	RP-161640	3807		В	CR:Introducation of test requirements for new UE behaviour	13.5.0
						(Rel-13)	
09/2016	RP-73	RP-161635	3811		F	Reference sensitivity exception for CA_20A-38A and CA_7A-	13.5.0
						20A-38A	
09/2016	RP-73	RP-161640	3816		F	Missing CA reference sensitivity exceptions	13.5.0
09/2016	RP-73	RP-161634	3821		A	Correction on subframe pair definition for PCMAX of DC	13.5.0
09/2016	RP-73	RP-161784	3826		A	Correction of CR Implementation error to 36.101	13.5.0
		RP-161636		4	_		
09/2016	RP-73		3693	1	D	Editorial correction to category NB1 specifications	13.5.0
09/2016	RP-73	RP-161637	3755	1	F	Editorial modification on TS36.101 for NB-IoT	13.5.0
09/2016	RP-73	RP-161636	3789	1	F	Corrections in 36.101 for NB-IoT UE	13.5.0
09/2016	RP-73	RP-161609	3714	1	В	Downlink physical channel setup for NB-IoT UE demodulation	13.5.0
						requirements	
09/2016	RP-73	RP-161609	3712	1	В	Introduction of NPDCCH demodulation requirements	13.5.0
09/2016	RP-73	RP-161636	3716	2	F	Corrections to channel bandwidth for category NB1 in	13.5.0
						TS36.101 (Rel-13)	
09/2016	RP-73	RP-161613	3782	1	В	Finalizing UE CQI requirements for 4Rx	13.5.0
09/2016	RP-73	RP-161613	3780	1	F	Corrections of UE requirements for 4Rx	13.5.0
09/2016	RP-73	RP-161611	3784	1	В	CR on eD2D demodulation performance requirements	13.5.0
09/2016	RP-73	RP-161782	3677	1	В	CR for eMTC M-PDCCH demodulation requirement for CE	13.5.0
03/2010	1(1-73	101702	3011	'		Mode B (Rel-13)	13.3.0
09/2016	RP-73	RP-161614	3722	1	В	Introduce PDCCH test for LAA demodulation	13.5.0
					_		
09/2016	RP-73	RP-161614	3718	1	В	Introduce aperiodic CSI test for LAA	13.5.0
09/2016	RP-73	RP-161615	3749	1	В	Introduction of EB/FD-MIMO PDSCH demodulation test	13.5.0
09/2016	RP-73	RP-161615	3748	1	В	Introduction of EB/FD-MIMO CRI Test	13.5.0
09/2016	RP-73	RP-161615	3842		F	CR: Correction of test parameters with Class B alternative	13.5.0
					1	codebook for one CSI-RS resource configured	
09/2016	RP-73	RP-161786	3646	1	F	CR on finalization of enhanced PDCCH/PCFICH performance	13.5.0
<u></u>	<u> </u>	<u></u>		<u> </u>	<u> </u>	requirements for DL control channel IM	
09/2016	RP-73	RP-161783	3683	1	В	CR for introducing LAA PDSCH demodulation performance	13.5.0
						requirements (Rel-13)	
09/2016	RP-73	RP-161610	3704	1	В	Introduction of TM2/TM9 PDSCH demodulation requirements	13.5.0
1						for eMTC	
09/2016	RP-73	RP-161781	3706	1	F	Correction of eMTC PDSCH TM6 demodulation requirements	13.5.0
09/2016	RP-73	RP-161781	3708	1	F	Correction of eMTC CQI definition test	13.5.0
09/2016	RP-73	RP-161610	3710	1	В	Introduction of UE-selected subband CQI test for eMTC	13.5.0
				+'-			
09/2016	RP-73	RP-161630	3829	1	A	Bracket removal for B3 and B39 UE co-existence	13.5.0
09/2016	RP-73	RP-161635	3838	 	F	Corrections of 3+41+42	13.5.0
09/2016	RP-73	RP-161638	3697	1	F	Guard band requirements for Band 46 MSD	13.5.0
09/2016	RP-73	RP-161786	3724	1	F	CR on finalization of enhanced PHICH performance	13.5.0
					1	requirements for DL control channel IM	
09/2016	RP-73	RP-161786	3725	1	F	CR on finalization of enhanced ePDCCH performance	13.5.0
				1	1	requirements for DL control channel IM	
09/2016	RP-73	RP-161613	3766	1	В	CR for applicability rule, antenna connection and test method	13.5.0
				1		for 4Rx UEs in Rel-13	
09/2016	RP-73	RP-161634	3805	1	F	Updated CA demodulation performance requirements (Rel-13)	13.5.0
09/2016	RP-73	RP-161635	3809	1	F	CR: On eDC demodulation performance requirements	13.5.0
09/2016	RP-73	RP-161783	3685	1	В	CR for reference channel for LAA demodulation performance	13.5.0
03/2010	117-13	NE-101/03	2002	1 '		requirements (Rel-13)	13.3.0
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09/2016	RP-73	RP-161611	3648	1	В	CR on introduction of OOC D2D Discovery demodulation requirements	13.5.0
00/0046	DD 70	DD 404700	2700	4	-		40.50
09/2016	RP-73	RP-161786	3700	1	F	Miscellaneous corrections of RF RX requirements for 4 RX AP	13.5.0
09/2016	RP-73	RP-161639	3642	1	F	Corrections on eMTC RX in TS 36.101	13.5.0
09/2016	RP-73	RP-161639	3844		F	Corrections for Rel-13 cat M1 UE	13.5.0
09/2016	RP-73	RP-161635	3777	1	F	Rel-13 CA corrections	13.5.0
09/2016	RP-73	RP-161640	3757	1	F	Corretion on operationg bands for ProSe	13.5.0
09/2016	RP-73	RP-161780	3815	2	В	CR on NPBCH Reference Measurement Channel for NB-IoT	13.5.0
09/2016	RP-73	RP-161780	3687	1	В	CR: NPDSCH Demodulation requirements and FRC definition	13.5.0
						for NB-IoT (Rel-13)	
09/2016	RP-73	RP-161614	3720	2	В	Introduce signal model for LAA demodulation	13.5.0
09/2016	RP-73	RP-161613	3768	2	В	CR for SDR - tests with 4Rx in Rel-13	13.5.0
09/2016	RP-73	RP-161782	3675	3	F	CR for eMTC M-PDCCH demodulation requirement for CE	13.5.0
03/2010	101 -73	101702	3073	3	'	Mode A (Rel-13)	13.3.0
12/2016	RP-74	RP-162428	3866	2	F	Improvement of REFSENS requirement specification for band	13.6.0
12/2010	NF-74	KF-102420	3000	_		46 CA combos	13.0.0
40/0046	DD 74	DD 400405	2075	2	_		40.00
12/2016	RP-74	RP-162435	3875	3	F	Clarification on UE maximum output power	13.6.0
12/2016	RP-74	RP-162386	3878	4	F	CR: Updates to LAA PDSCH demodulation performance	13.6.0
						requirements (Rel-13)	
12/2016	RP-74	RP-162386	3880	1	F	CR: Updates to the reference channel for LAA demodulation	13.6.0
						performance requirements (Rel-13)	
12/2016	RP-74	RP-162383	3884	3	F	CR for Rel-13 eMTC MPDCCH demodulation requirements	13.6.0
12/2016	RP-74	RP-162435	3886	1	F	CR for correction on OCNG pattern (Rel-13)	13.6.0
12/2016	RP-74	RP-162431	3890		F	RMC for maximum input level in category M1 UE	13.6.0
12/2016	RP-74	RP-162434	3896	1	F	A-MPR for NB-IoT	13.6.0
12/2016	RP-74	RP-162459	3900		Α	CR for updating applicability rule for UE cat 9 Ues and DL Cat.	13.6.0
12/2010		1 102.100	0000		' '	13 UEs in Rel-13	10.0.0
12/2016	RP-74	RP-162423	3902	2	F	CR for IRC TM2/3/3 tests with 4Rx in Rel-13	13.6.0
12/2016	RP-74	RP-162423	3904	2	F	CR for removing square brakets for 4Rx tests in Rel-13	13.6.0
12/2016	RP-74	RP-162412	3926				
				0	A	UE to UE co-existence for B42 with 2ULs	13.6.0
12/2016	RP-74	RP-162383	3928	3	F	Correction of PDCSH demodulation requirements for eMTC	13.6.0
12/2016	RP-74	RP-162404	3945	1	F	Clarification of note6 for 3DL/2UL CA	13.6.0
12/2016	RP-74	RP-162423	3947		F	CR for SDR CA tests with 4Rx for DL category 18 and 19	13.6.0
12/2016	RP-74	RP-162434	3951	1	F	Clarification on TX-RX frequency separation for Cat.NB1 (Rel-	13.6.0
						13)	
12/2016	RP-74	RP-162423	3956	2	F	CR for fixing errors for 4Rx tests in Rel-13	13.6.0
12/2016	RP-74	RP-161988	3868	1	В	Addition of 1.4 and 3 MHz channel bandwidths for BAND 65 in	13.6.0
						TS36.101 (Rel-13)	
12/2016	RP-74	RP-162423	3970	2	F	CR on 4-RX TM9 MU test	13.6.0
12/2016	RP-74	RP-162430	3977	1	F	Correction of power control for category M1	13.6.0
12/2016	RP-74	RP-162386	3980	3	F	Clean up and clarification for LAA CSI requirements	13.6.0
12/2016	RP-74	RP-162386	3982	1	F	Add PDCCH performance requirements for LAA demodulation	13.6.0
12/2016	RP-74	RP-162415	3995	<u> </u>	A	Correction to cell mapping for periodic CQI reporting on	13.6.0
12/2010	101 -74	102413	3333		^	multiple cells	13.0.0
12/2016	RP-74	RP-162430	3997		F	UE cat M1 out of band blocking, Removal of Range 4	13.6.0
12/2016	RP-74	RP-162425	3998		F	Remove square brackets for Rel-13 FD-MIMO performance	13.6.0
12/2016	KF-74	KF-102423	3990		Г		13.6.0
40/0046	DD 74	DD 400400	4004	4	F	requirements	40.00
12/2016	RP-74	RP-162430	4001	1		CR for 36.101: frequency error for eMTC	13.6.0
12/2016	RP-74	RP-162456	4004	2	F	CR: Updates to NPDSCH demodulation requirements for NB-	13.6.0
10/0-:-	55.5	55.46	105-		<u> </u>	loT (Rel-13)	10.0-
12/2016	RP-74	RP-162384	4008	2	F	CR for Rel-13 eMTC PBCH demodulation requirement for	13.6.0
	<u> </u>				<u> </u>	enhanced coverage	
12/2016	RP-74	RP-162435	4011		F	CR: Corrections for bandwidth combination sets defined for	13.6.0
						inter-band DC (Rel-13)	
12/2016	RP-74	RP-162411	4021		Α	RMCs and applicabilility of core RF requirements	13.6.0
12/2016	RP-74	RP-162411	4030		Α	Correction of spurious emissions requirements for Band 9	13.6.0
			<u> </u>	<u> </u>		range and intra-band CA	
12/2016	RP-74	RP-162435	4039		F	Optional PCell indication	13.6.0
12/2016	RP-74	RP-162380	4041	1	F	Correction of NPDCCH demodulation requirements	13.6.0
12/2016	RP-74	RP-162383	4043	1	F	Finalizing CQI definition test for eMTC	13.6.0
12/2016	RP-74	RP-162383	4045	1	F	Finalizing UE-selected subband CQI test for eMTC	13.6.0
12/2016	RP-74	RP-162430	4047	1	F	Correction of REFSENS RMC table for Cat-M1 UE	13.6.0
12/2016	RP-74	RP-162433	4058	1	F	NB-IoT aggregate power control Rel-13	13.6.0
	RP-74			2	F		
12/2016	KF-/4	RP-162433	4060	~	-	Correction to NB-IoT ON/OFF power measurement period	13.6.0
10/0010	DD 74	DD 460405	4004	2	+-	Rel-13	12.6.0
12/2016	RP-74	RP-162435	4064	2	F	Corrections to CA table reference and header and CA	13.6.0
10/			45	ļ.,	<u> </u>	REFSENS table	10 - 1
12/2016	RP-74	RP-162435	4076	1	F	Corrections of CA Refsens exceptions in 7.3.1A (Rel-13)	13.6.0
12/2016	RP-74	RP-162435	4080	2	F	DeltaRIB for SDL and LAA CA	13.6.0
12/2016	RP-74	RP-162420	4084		Α	CR for fixing soft buffer management test for TDD-FDD CA in	13.6.0
						Rel-13	
12/2016	RP-74	RP-162435	4086	1	F	CR for fixing editorial errors in Rel-13	13.6.0
12/2016	RP-74	RP-162404	4090		Α	Introduction of MSD requirement for IMD5 on band3 of	13.6.0
	1		1		1	CA_3A-8A 2UL CA '	1

12/2016	RP-74	RP-162386	4092	1	F	CR: Updates to burst transmission model for LAA performance requirements (Rel-13)	13.6.0
12/2016	RP-74	RP-162406	4101		Α	Versioning indicator bit for NS_04 A-MPR table	13.6.0
12/2016	RP-74	RP-162427	4103	1	F	Band 68 NS_26 A-MPR correction	13.6.0
12/2016	RP-74	RP-162420	4110		Α	RF: Pb setting in power imbalance TCs (Rel-13)	13.6.0
12/2016	RP-74	RP-162420	4113		A	RF: Correction to RMC for UE Category 1 in CSI tests (Rel-13)	13.6.0
12/2016	RP-74	RP-162413	4117		A	RF: Beamforming model missing in chapter 9 TM9 receiver	13.6.0
12/2016	RP-74	RP-162459	4123		Α	Type A tests (Rel-13) RF: Incorrect Number of EREGs per ECCE for special	13.6.0
12/2016	RP-74	RP-162428	4126	1	F	subframe mentioned for TC 8.7.4 (Rel-13) MSD and exclusion region specification for 10MHz LAA	13.6.0
		RP-162431	4132		F	channels Missing requirements for eMTC/NB IoT UE	
12/2016	RP-74			1			13.6.0
12/2016	RP-74	RP-162380	4136	1	В	CR on NPBCH Fixed Reference Channel for NB-IoT	13.6.0
01/2017	RP-74	DD 470504	4400	.	_	Page header information update	13.6.1
03/2017	RP-75	RP-170594	4138	1	F	Correction to carrier leakage and in-band emission for Cat. M1 UE	13.7.0
03/2017	RP-75	RP-170594	4140	1	F	Correction to Transmission Gap of Aggregate Power Control for Cat. M1 HD-FDD UE	13.7.0
03/2017	RP-75	RP-170592	4145		F	Correction for LAA TM9 CQI test (R13)	13.7.0
03/2017	RP-75	RP-170603	4152		F	Correction for FD-MIMO CRI test (R13)	13.7.0
03/2017	RP-75	RP-170603	4155		D	Split RMC overview table (R13)	13.7.0
03/2017	RP-75	RP-170587	4157	1	F	4Rx lot connections for 2Rx CQI requirement with frequency- selective interference	13.7.0
03/2017	RP-75	RP-170588	4162		F	Correction to UL/DL configuration & Special subframe configuration for CA CQI tests	13.7.0
03/2017	RP-75	RP-170597	4164		F	Remove [] from UE Cat M1 MPDCCH demodulation SNR	13.7.0
03/2017	RP-75	RP-170589	4171		F	values Missing harmonic reference sensitivity exception for CA_20A-	13.7.0
03/2017	RP-75	RP-170589	4174		F	42A and CA_20A-42A-42A Correction to MPR table for intra-band 2UL CA	13.7.0
03/2017	RP-75	RP-170603	4184	1	F	Correction of Rel-13 CA REFSENS exceptions	13.7.0
03/2017	RP-75	RP-170597	4191	1	F	Finalize eMTC PDSCH demodulation requirements	13.7.0
03/2017	RP-75	RP-170597	4193	<u> </u>	F	Finalize eMTC CQI test requirements	13.7.0
03/2017	RP-75	RP-170594	4197	1	F	Correction of FRC table for eMTC RF test	13.7.0
03/2017	RP-75	RP-170594	4203	1	F	Clean up and correction for LAA PDCCH demodulation requirements	13.7.0
03/2017	RP-75	RP-170599	4207	2	F	PCMAX tolerance for UE Cat NB1 power class 5	13.7.0
03/2017	RP-75	RP-170580	4212	-	Α	Addition of missing note for bands 7 and 39 UE to UE co-ex	13.7.0
03/2017	RP-75	RP-170580	4216		A	Correction of CA_NS_06 non-contiguous resource allocation MPR formula	13.7.0
03/2017	RP-75	RP-170592	4222	1	F	CR: Updates to LAA PDSCH demodulation performance	13.7.0
03/2017	RP-75	RP-170598	4224	2	F	requirements and LBT(R13) CR: Scheduling pattern for NPUSCH format 1 and NPDSCH in	13.7.0
03/2017	RP-75	RP-170601	4226	2	F	NB-IoT RF test(R13) CR:Updates to the overview of RMC for NB-IoT(R13)	13.7.0
03/2017	RP-75	RP-170601	4228	1	F	CR:Cleanup for NB-IoT UE demod performance	13.7.0
03/2017	RP-75	RP-170585	4231	1	^	requirements(R13) Corrections for D2D resource configuration (Rel-13)	13.7.0
03/2017	RP-75	RP-170585	4231	1	F	clean up the CR for eMTC PBCH requirements(Rel-13)	13.7.0
03/2017	RP-75	RP-170595	4242	'	A	CR for fixing requirement for soft buffer test for TDD-FDD CA	13.7.0
03/2017	RP-75	RP-170587	4244		F	in Rel-13 CR for fixing power ratio errors in 4Rx tests in Rel-13	13.7.0
03/2017	RP-75	RP-170587	4253	1	F	CR for correcting applicability rules for 4Rx tests in Rel-13	13.7.0
03/2017	RP-75	RP-170598	4276	1	F	CR for clarification on SEM of category NB1 [Rel-13]	13.7.0
03/2017	RP-75	RP-170594	4277	t i	F	CR of TX-RX frequency separation for category M1 [Rel-13]	13.7.0
03/2017	RP-75	RP-170587	4281	1	F	CR for fixing antenna configuration for TDD CQI rank 3 test for 4Rx in Rel-13	13.7.0
03/2017	RP-75	RP-170594	4284		F	Reference Channels for partial RB allocation for UE UL	13.7.0
00/0047	DD 75	DD 470500	4000	_	-	category M1	40.7.0
03/2017	RP-75	RP-170598	4292	<u> </u>	F	Corrections in TS 36.101 for NB-IoT UE	13.7.0
03/2017	RP-75	RP-170587	4295	1	F	CR for removing SDR 4Rx tests in Rel-13	13.7.0
06/2017	RP-76	RP-171304	4298		F	Correction to 4Tx/4Rx Cell-specific reference signals in Table 8.10.1.1.7-1	13.8.0
06/2017	RP-76	RP-171308	4305		F	Correction to UL and DL Reference Channels for Cat M1 UE	13.8.0
06/2017	RP-76	RP-171296	4308		Α	Corrections for D2D FRCs	13.8.0
06/2017	RP-76	RP-171395	4317		Α	Correction to SEM table for intra-band 2UL CA	13.8.0
06/2017	RP-76	RP-171310	4319	1	F	Cleanup of eMTC UE demodulation requirements (Rel-13)	13.8.0
06/2017	RP-76	RP-171311	4321		F	Correction for FD-MIMO demodulation test (R13)	13.8.0
06/2017	RP-76	RP-171301	4357	ļ	F	Correction of NPDSCH and NPDCCH	13.8.0
06/2017	RP-76	RP-171304	4359	ļ	F	Maintenance CR for 4Rx WI (Rel-13)	13.8.0
06/2017	RP-76	RP-171304	4372	1	F	CR on 4-RX TM9 MU-MIMO performance requirements (Rel-13)	13.8.0
06/2017	RP-76	RP-171298	4374		F	CR on PDCCH/PCFICH DL Control Channel IM Type A TDD	13.8.0

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						test case correction (Rel-13)	
06/2017	RP-76	RP-171296	4381	1	F	Corrections of Table 8.7.5.1-2 and Table 8.7.5.2-27	13.8.0
06/2017	RP-76	RP-171309	4382	0	F	Correction to Table A.4-1 and A.4-16 for Cat M1.	13.8.0
06/2017	RP-76	RP-171310	4384	2	F	Correction to minimum requirement for CatM1 Single-Layer Spatial Multiplexing	13.8.0
06/2017	RP-76	RP-171300	4388		F	CR for demodulation of NB-IoT correction (Rel.13)	13.8.0
06/2017	RP-76	RP-171307	4390		F	CR for LAA TDD test case correction (Rel.13)	13.8.0
06/2017	RP-76	RP-171395	4395		F	Correction to the table of intra-band non-contiguous CA with	13.8.0
						one uplink configuration for reference sensitivity	
06/2017	RP-76	RP-171297	4404		F	Correction of N_RB_agg for CA_41C and CA_7C in Table	13.8.0
06/2017	RP-76	RP-171296	4411		Α	7.3.1A-1 Correction to Mapping of CQI Index to Modulation coding	13.8.0
00/2017	KF-76	KF-171290	4411		\ ^	scheme for 256QAM	13.6.0
06/2017	RP-76	RP-171304	4413	1	F	CR for correction of 4RX demodulation requirements (Rel-13)	13.8.0
06/2017	RP-76	RP-171311	4423	1	F	Correction of test points for Single-antenna port performance	13.8.0
						TDD FDD CA	
06/2017	RP-76	RP-171304	4436		D	CR for FRC overview table for 4 layer SDR tests (R13)	13.8.0
06/2017	RP-76	RP-171307	4439	2	D	Maintenance CR for LAA demodulation tests	13.8.0
06/2017	RP-76	RP-171304	4445	1	F	4Rx REFSENS requirements spec improvement for 36.101	13.8.0
06/2017	RP-76	RP-171311	4447		F	CR for adding TDD 4 DL CA bandwidth combination for CQI CA tests in Rel-13	13.8.0
06/2017	RP-76	RP-171304	4449	1	F	CR for adding applicability rule for MU TM9 4Rx tests in Rel-	13.8.0
00/2017	10 70	10171304	7773	l '	1'	13	13.0.0
06/2017	RP-76	RP-171311	4466		F	Correction on TDD-FDD CSI test cases (R13)	13.8.0
06/2017	RP-76	RP-171297	4472		Α	Corrections for inCoverage configuration in ProSe direct	13.8.0
						communication (Rel-13)	
06/2017	RP-76	RP-171299	4474	1	F	CR for NB-IoT Absolute power tolerance	13.8.0
06/2017	RP-76	RP-171307	4476	2	F	Update of LAA REFSENS exclusion region	13.8.0
09/2017	RP-77	RP-171973	4486	1	F	Corrections on Rel-13 CA requirements	13.9.0
09/2017 09/2017	RP-77	RP-171973 RP-171971	4504 4509	1	F	Addition of OCNG Pattern for LAA Rx tests PDSCH Demodulation downlink power allocation parameters	13.9.0 13.9.0
09/2017	KF-77	KF-1/19/1	4309		'	for UEs supporting coverage enhancement	13.9.0
09/2017	RP-77	RP-171970	4513		F	Correction to Test Parameters for MPDCCH in Table 8.11.2.1-	13.9.0
						1	
09/2017	RP-77	RP-171965	4516	2	Α	Correction of band 43 spurious emissions limit (Rel-13)	13.9.0
09/2017	RP-77	RP-171947	4540	1	В	Band 68 modification to enable operation in Europe Rel-13	13.9.0
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