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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
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In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

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

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

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

can indicates that something is possible

cannot indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

1 Scope

The present document specifies the measurement procedures for the conformance test of the NR User Equipment (UE) supporting satellite access operation that contains RF and Performance requirements.

2 References

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

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

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.521-1: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone".

[3] Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".

[4] 3GPP TS 38.108: "NR; Satellite Node radio transmission and reception".

[5] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[6] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".

[7] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[8] 3GPP TS 38.331: "Radio Resource Control (RRC) protocol specification".

[9] 3GPP TS 38.300: "NR; NR and NG-RAN Overall description; Stage-2".

[10] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception".

[11] 3GPP TS 38.101-5: "NR; User Equipment (UE) radio transmission and reception; Part 5: Satellite access Radio Frequency (RF) and performance requirements".

[12] 3GPP TS 38.508-1: "5GS; User Equipment (UE) conformance specification; Part 1: Common test environment ".

[13] 3GPP TS 38.306: "User Equipment (UE) radio access capabilities".

[14] 3GPP TS 38.521-4: “NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 4: Performance requirements".

[15] ITU-R Recommendation SM.329-10, “Unwanted emissions in the spurious domain”

[16] 3GPP TS 38.214: "NR; Physical layer procedures for data".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

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

Geosynchronous Earth Orbit: Earth-centred orbit at approximately 35786 kilometres above Earth's surface and synchronised with Earth's rotation. A geostationary orbit is a non-inclined geosynchronous orbit, i.e. in the Earth's equator plane.

Low Earth Orbit: Orbit around the Earth with an altitude between 300 km, and 1500 km.

Non-terrestrial networks: Networks, or segments of networks, using an airborne or space-borne vehicle to embark a transmission equipment relay node or base station.

Satellite: A space-borne vehicle embarking a bent pipe payload or a regenerative payload telecommunication transmitter, placed into Low-Earth Orbit (LEO), Medium-Earth Orbit (MEO), or Geostationary Earth Orbit (GEO).

Satellite Access Node: see definition in TS 38.108 [4].

UE transmission bandwidth configuration: Set of resource blocks located within the UE channel bandwidth which may be used for transmitting or receiving by the UE.

3.2 Symbols

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

ΔF_{Global}	Granularity of the global frequency raster
ΔF_{Raster}	Band dependent channel raster granularity
$BW_{Channel}$	Channel bandwidth
$BW_{interferer}$	Bandwidth of the interferer
F_{DL_low}	The lowest frequency of the downlink *operating band*
F_{DL_high}	The highest frequency of the downlink *operating band*
F_{UL_low}	The lowest frequency of the uplink *operating band*
F_{UL_high}	The highest frequency of the uplink *operating band*
$F_{Interferer}$	Frequency of the interferer
$F_{Interferer}$ (offset)	Frequency offset of the interferer (between the center frequency of the interferer and the carrier frequency of the carrier measured)
$F_{Ioffset}$	Frequency offset of the interferer (between the center frequency of the interferer and the closest edge of the carrier measured)
F_{OOB}	The boundary between the NR out of band emission and spurious emission domains
F_{REF}	RF reference frequency
$F_{REF-Offs}$	Offset used for calculating F_{REF}
F_{uw} (offset)	The frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer
N_{RB}	Transmission bandwidth configuration, expressed in units of resource blocks
N_{REF}	NR Absolute Radio Frequency Channel Number (NR-ARFCN)
$N_{REF-Offs}$	Offset used for calculating N_{REF}
$P_{Interferer}$	Modulated mean power of the interferer
P_{uw}	Power of an unwanted DL signal

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].

ACLR	Adjacent Channel Leakage Ratio
ACS	Adjacent Channel Selectivity

A-MPR	Additional Maximum Power Reduction
BW	Bandwidth
BWP	Bandwidth Part
CP-OFDM	Cyclic Prefix-OFDM
CW	Continuous Wave
DFT-s-OFDM	Discrete Fourier Transform-spread-OFDM
DM-RS	Demodulation Reference Signal
DTX	Discontinuous Transmission
EIRP	Equivalent Isotropically Radiated Power
EVM	Error Vector Magnitude
FR	Frequency Range
FRC	Fixed Reference Channel
GEO	Geosynchronous Earth Orbit
GSCN	Global Synchronization Channel Number
IBB	In-band Blocking
ITU-R	Radiocommunication Sector of the International Telecommunication Union
LEO	Low Earth Orbiting
MBW	Measurement bandwidth defined for the protected band
MEO	Medium Earth Orbiting
MOP	Maximum Output Power
MPR	Allowed maximum power reduction
MSD	Maximum Sensitivity Degradation
NGEO	Non-Geostationary Earth Orbiting
NR	New Radio
NR-ARFCN	NR Absolute Radio Frequency Channel Number
NS	Network Signalling
NTN	Non-Terrestrial Network
OCNG	OFDMA Channel Noise Generator
OOB	Out-of-band
PRB	Physical Resource Block
QAM	Quadrature Amplitude Modulation
RAN	Radio Access Network
RE	Resource Element
REFSENS	REFerence SENSitivity
RF	Radio Frequency
RMS	Root Mean Square (value)
RSRP	Reference Signal Receive Power
RSRQ	Reference Signal Receive Quality
RX	Receiver
SAN	Satellite Access Node
SC	Single Carrier
SCS	Subcarrier spacing
SEM	Spectrum Emission Mask
SNR	Signal-to-Noise Ratio
SRS	Sounding Reference Symbol
SS	Synchronization Symbol
TN	Terrestrial Network
TX	Transmitter
TxD	Tx Diversity
UE	User Equipment

4 General

4.1 Relationship between minimum requirements and test requirements

TS 38.101-5 [11] is a Single-RAT specification for satellite NR UE, covering RF characteristics and minimum performance requirements. Conformance to the TS 38.101-5 [11] is demonstrated by fulfilling the test requirements specified in the present document.

The Minimum Requirements given in TS 38.101-5 [11] makes no allowance for measurement uncertainty (MU). The present document defines test tolerances (TT). These test tolerances are individually calculated for each test. The test tolerances are used to relax the minimum requirements in TS 38.101-5 [11] to create test requirements. For some requirements, including regulatory requirements, the test tolerance is set to zero.

The measurement results returned by the test system are compared - without any modification - against the test requirements as defined by the various levels of "shared risk" principle as described below.

a) Core specification value is not relaxed by any relaxation value (TT=0). For each single measurement, the probability of a borderline good UE being judged as FAIL equals the probability of a borderline bad UE being judged as PASS.

   - Test tolerances equal to 0 (TT=0) are considered in this specification.

b) Core specification value is relaxed by a relaxation value (TT>0). For each single measurement, the probability of a borderline bad UE being judged as PASS is greater than the probability of a borderline good UE being judged as FAIL.

   - Test tolerances lower than measurement uncertainty and greater than 0 (0 < TT < MU) are considered in this specification.

   - Test tolerances high up to measurement uncertainty (TT = MU) are considered in this specification which is also known as "Never fail a good DUT" principle.

c) Core specification value is tightened by a stringent value (TT<0). For each single measurement, the probability of a borderline good UE being judged as FAIL is greater than the probability of a borderline bad UE being judged as PASS.

Test tolerances lower than 0 (TT<0) are not considered in this specification. The "Never fail a good DUT" and the "Shared Risk" principles are defined in Recommendation ITU-R M.1545 [3].

4.2 Applicability of minimum requirements

The Minimum Requirements are specified as general requirements and additional requirements. The applicability of each requirement is described under clauses 6.1, 7.1, 8.1 of TS 38.101-5 [11].

The conducted minimum requirements specified in TS 38.101-5 [11] as a general requirement, the requirement shall be met in all applicable scenarios for FR1. 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.

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.

4.3 Specification suffix information

Specification suffix information is not defined for the time being in Release 17.

4.4 Relationship with core specifications

TS 38.101-5 [11] specifies the minimum RF and performance requirements for NR User Equipment (UE) operating in a Non-Terrestrial Network. TS 38.108 [4] specifies the minimum RF and performance requirements of Satellite Access Node (SAN).

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.

Requirements throughout the RF specifications are in many cases defined separately for different frequency ranges (FR). The frequency ranges in which NTN satellite can operate according to this version of the specification are identified as described in Table 5.1-1.

Table 5.1-1: Definition of frequency ranges

Frequency range designation	Corresponding frequency range
FR1	410 MHz – 7,125 MHz

The present specification covers FR1 operating bands.

5.2 Operating bands

5.2.1 General

NTN satellite covers FR1 operating bands in the present specification.

5.2.2 Operating bands with conducted requirements

NTN satellite is designed to operate in the operating bands defined in Table 5.2.2-1.

Table 5.2.2-1: NTN satellite bands in FR1

NTN satellite operating band	Uplink (UL) operating band Satellite Access Node receive / UE transmit $F_{UL,low}$ – $F_{UL,high}$	Downlink (DL) operating band Satellite Access Node transmit / UE receive $F_{DL,low}$ – $F_{DL,high}$	Duplex mode
n256	1,980MHz – 2,010 MHz	2,170 MHz – 2,200 MHz	FDD
n255	1,626.5 MHz – 1,660.5 MHz	1,525 MHz – 1,559 MHz	FDD
NOTE: NTN satellite bands are numbered in descending order from n256.			

5.2.3 reserved (for radiated requirements)

[To be updated]

5.3 UE channel bandwidth

5.3.1 General

The UE channel bandwidth supports a single RF carrier in the uplink or downlink at the UE. From a SAN perspective, different UE channel bandwidths may be supported within the same spectrum for transmitting to and receiving from UEs connected to the SAN.

From a UE perspective, the UE is configured with one or more BWP / carriers, each with its own UE channel bandwidth. The UE does not need to be aware of the SAN channel bandwidth or how the SAN allocates bandwidth to different UEs.

The placement of the UE channel bandwidth for each UE carrier is flexible but can only be completely within the SAN channel bandwidth.

The relationship between the channel bandwidth, the guardband and the maximum transmission bandwidth configuration is shown in Figure 5.3.1-1.

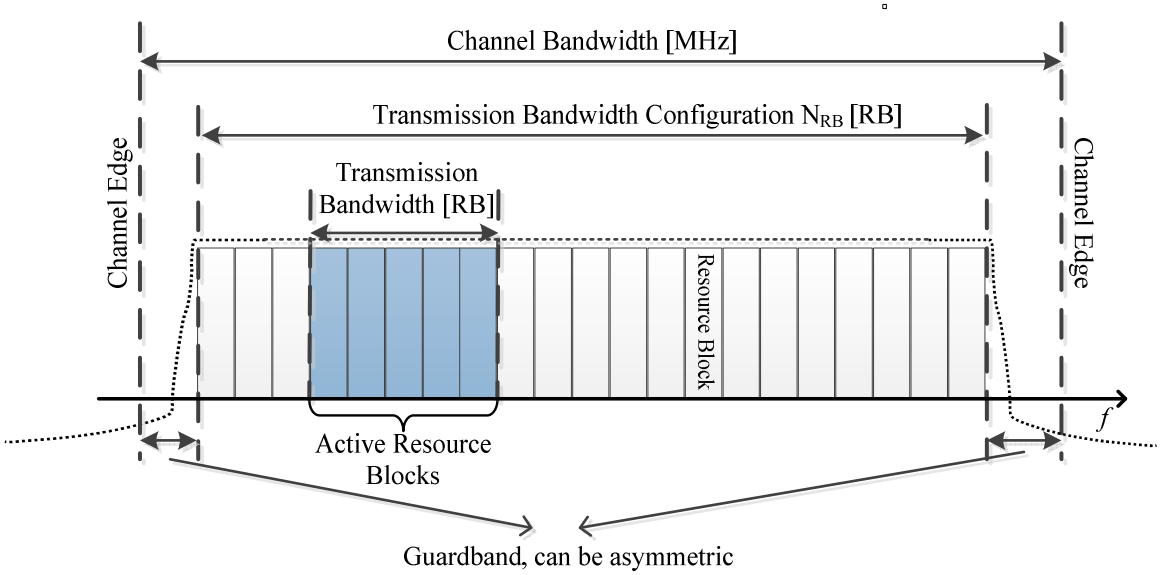

Figure 5.3.1-1: Definition of the channel bandwidth and the maximum transmission bandwidth configuration for one channel

5.3.2 Maximum transmission bandwidth configuration

The maximum transmission bandwidth configuration N_{RB} for each UE channel bandwidth and subcarrier spacing is specified in Table 5.3.2-1.

Table 5.3.2-1: Maximum transmission bandwidth configuration N_{RB}

SCS (kHz)	5 MHz	10 MHz	15 MHz	20 MHz
	N_{RB}	N_{RB}	N_{RB}	N_{RB}
15	25	52	79	106
30	11	24	38	51
60	N/A	11	18	24

5.3.3 Minimum guardband and transmission bandwidth configuration

The minimum guardband for each UE channel bandwidth and SCS is specified in Table 5.3.3-1.

Table 5.3.3-1: Minimum guardband for each UE channel bandwidth and SCS (kHz)

SCS (kHz)	5 MHz	10 MHz	15 MHz	20 MHz
15	242.5	312.5	382.5	452.5
30	505	665	645	805
60	N/A	1,010	990	1,330

NOTE: The minimum guardbands have been calculated using the following equation: ($BW_{Channel}$ x 1,000 (kHz) - N_{RB} x SCS x 12) / 2 - SCS/2, where N_{RB} are from Table 5.3.2-1.

Figure 5.3.3-1: Void

The number of RBs configured in any channel bandwidth shall ensure that the minimum guardband specified in this clause is met.

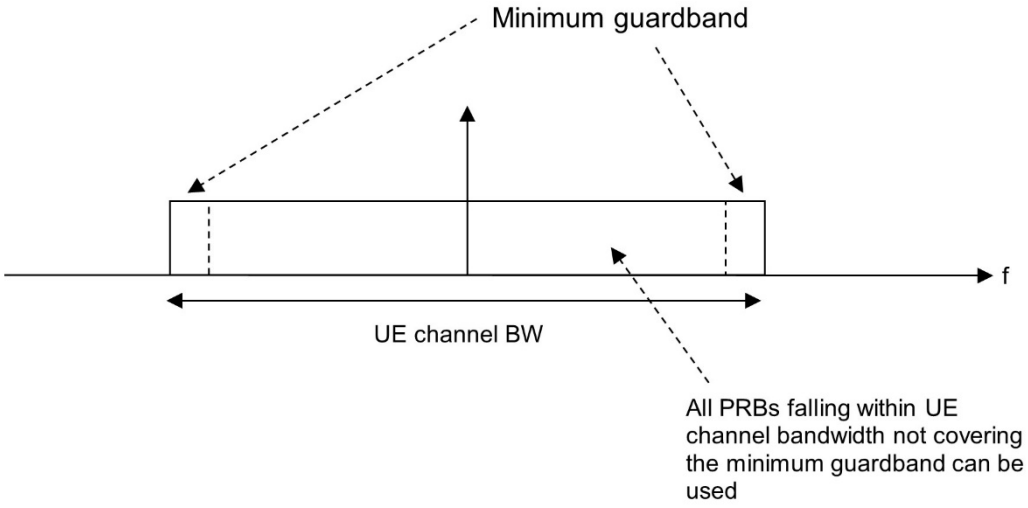

Figure 5.3.3-2: UE PRB utilization

In the case that multiple numerologies are multiplexed in the same symbol, the minimum guard band on each side of the carrier is the guard band applied at the configured UEchannel bandwidth for the numerology that is transmitted/received immediately adjacent to the guard band.

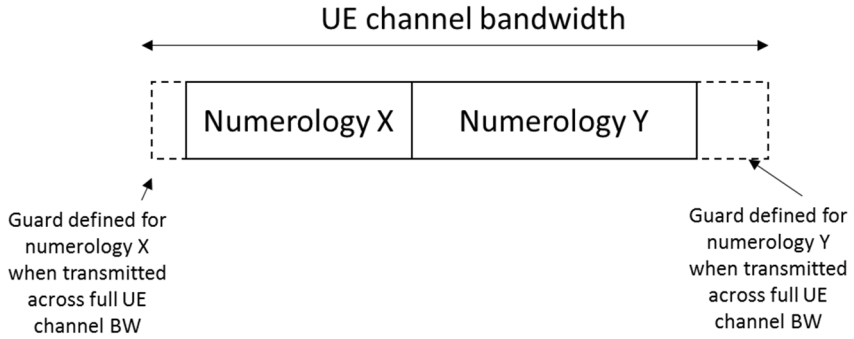

Figure 5.3.3-3: Guard band definition when transmitting multiple numerologies

NOTE: Figure 5.3.3-2 is not intended to imply the size of any guard between the two numerologies. Inter-numerology guard band within the carrier is implementation dependent.

5.3.4 RB alignment

The RB alignment refers to NR RB alignments as specified in 3GPP TS 38.101-1 [5] clause 5.3.4.

5.3.5 UE channel bandwidth per operating band

The requirements in this specification apply to the combination of channel bandwidths, SCS and operating bands shown in Table 5.3.5-1. The transmission bandwidth configuration in Table 5.3.2-1 shall be supported for each of the specified channel bandwidths. The channel bandwidths are specified for both the TX and RX path.

Table 5.3.5-1: Channel bandwidths for each NTN satellite band

NTN satellite band	SCS kHz	UE Channel bandwidth (MHz)			
		5	10	15	20
n256	15	5	10	15	20
	30		10	15	20
	60		10	15	20
n255	15	5	10	15	20
	30		10	15	20
	60		10	15	20

5.4 Channel arrangement

5.4.1 Channel spacing

5.4.1.1 Channel spacing for adjacent NTN satellite carriers

The channel spacing for adjacent NTN satellite carriers refers to the NR channel spacing as specified in TS 38.101-1 [5] clause 5.4.1.1.

5.4.2 Channel raster

5.4.2.1 NR-ARFCN and channel raster

The global frequency channel raster defines a set of RF reference frequencies $F_{REF.}$ The RF reference frequency is used in signalling to identify the position of RF channels, SS blocks and other elements.

The global frequency raster is defined for all frequencies from 0 to 100 GHz. The granularity of the global frequency raster is ΔF_{Global}.

RF reference frequencies are designated by an NR Absolute Radio Frequency Channel Number (NR-ARFCN) in the range (0…2016666) on the global frequency raster. The relation between the NR-ARFCN and the RF reference frequency F_{REF} in MHz is given by the following equation, where $F_{REF-Offs}$ and $N_{REF-Offs}$ are given in Table 5.4.2.1-1 and N_{REF} is the NR-ARFCN.

$$F_{REF} = F_{REF-Offs} + \Delta F_{Global} (N_{REF} - N_{REF-Offs})$$

Table 5.4.2.1-1: NR-ARFCN parameters for the global frequency raster

Frequency range (MHz)	ΔF_{Global} (kHz)	$F_{REF-Offs}$ (MHz)	$N_{REF-Offs}$	Range of N_{REF}
0 – 3,000	5	0	0	0 – 599,999

The channel raster defines a subset of RF reference frequencies that can be used to identify the RF channel position in the uplink and downlink. The RF reference frequency for an RF channel maps to a resource element on the carrier. For each operating band, a subset of frequencies from the global frequency raster are applicable for that band and forms a channel raster with a granularity ΔF_{Raster}, which may be equal to or larger than ΔF_{Global}.

The mapping between the channel raster and corresponding resource element is given in clause 5.4.2.2. The applicable entries for each operating band are defined in clause 5.4.2.3.

5.4.2.2 Channel raster to resource element mapping

The mapping between the RF reference frequency on the channel raster and the corresponding resource element refers to the NR requirements specified in 3GPP TS 38.101-1 [5] clause 5.4.2.2.

5.4.2.3 Channel raster entries for each operating band

The RF channel positions on the channel raster in each NTN satellite operating band are given through the applicable NR-ARFCN in Table 5.4.2.3-1, using the channel raster to resource element mapping in clause 5.4.2.2.

For NTN satellite operating bands with 100 kHz channel raster, $\Delta F_{Raster} = 20 \times \Delta F_{Global}$. In this case every 20th NR-ARFCN within the operating band are applicable for the channel raster within the operating band and the step size for the channel raster in Table 5.4.2.3-1 is given as <20>.

Table 5.4.2.3-1: Applicable NR-ARFCN per operating band

NTN satellite operating band	ΔF_{Raster} (kHz)	Uplink Range of N_{REF} (First – <Step size> – Last)	Downlink Range of N_{REF} (First – <Step size> – Last)
n256	100	396,000 – <20> – 402,000	434,000 – <20> – 440,000
n255	100	325,300 – <20> – 332,100	305,000 – <20> – 311,800
NOTE: 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.			

5.4.3 Synchronization raster

5.4.3.1 Synchronization raster and numbering

The synchronization raster indicates the frequency positions of the synchronization block that can be used by the UE for system acquisition when explicit signalling of the synchronization block position is not present.

A global synchronization raster is defined for all frequencies. The frequency position of the SS block is defined as SS_{REF} with corresponding number GSCN. The parameters defining the SS_{REF} and GSCN for all the frequency ranges are in Table 5.4.3.1-1.

The resource element corresponding to the SS block reference frequency SS_{REF} is given in clause 5.4.3.2. The synchronization raster and the subcarrier spacing of the synchronization block is defined separately for each band.

Table 5.4.3.1-1: GSCN parameters for the global frequency raster

Frequency range	SS Block frequency position SS_{REF}	GSCN	Range of GSCN
0 – 3,000 MHz	N * 1,200 kHz + M * 50 kHz, N=1:2,499, M ϵ {1,3,5}[1]	3N + (M-3)/2	2 – 7,498
NOTE: The default value for operating bands with which only support SCS spaced channel raster(s) is M=3.			

5.4.3.2 Synchronization raster to synchronization block resource element mapping

The mapping between the synchronization raster and the corresponding resource element of the SS block refers to 3GPP TS 38.101-1 [5] clause 5.4.3.2.

5.4.3.3 Synchronization raster entries for each operating band

The synchronization raster for each band is give in Table 5.4.3.3-1. The distance between applicable GSCN entries is given by the <Step size> indicated in Table 5.4.3.3-1.

Table 5.4.3.3-1: Applicable SS raster entries per operating band

NTN satellite operating band	SS Block SCS	SS Block pattern[1]	Range of GSCN (First – <Step size> – Last)
n256	15 kHz	Case A	5,429 – <1> – 5,494
n255	15 kHz	Case A	3,818 – <1> – 3,892
	30 kHz	Case B	3,824 – <1> – 3,886
NOTE : SS Block pattern is defined in clause 4.1 in 3GPP TS 38.213 [7].			

5.4.4 TX–RX frequency separation

The default TX channel (carrier centre frequency) to RX channel (carrier centre frequency) separation for operating bands is specified in Table 5.4.4-1.

Table 5.4.4-1: UE TX-RX frequency separation

NTN Satellite Operating Band	TX – RX carrier centre frequency separation
n256	190 MHz
n255	-101.5 MHz

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. Handheld power class 3 UE is assumed in Release 17 for satellite access.

All requirements in this clause are applicable to devices supporting GSO and/or NGSO satellites.

Unless otherwise stated, Channel Bandwidth shall be prioritized in the selecting of test points. Subcarrier spacing shall be selected after Test Channel Bandwidth is selected.

Uplink RB allocations given in Table 6.1-1 are used throughout this clause, unless otherwise stated by the test case.

Table 6.1-1: Common uplink configuration

Channel Bandwidth	SCS(kHz)	OFDM	RB allocation							
			Edge_Full_Left	Edge_Full_Right	Edge_1RB_Left	Edge_1RB_Right	Outer_Full	Inner_Full	Inner_1RB_Left	Inner_1RB_Right
5MHz	15	DFT-s	2@0	2@23	1@0	1@24	25@0	12@6	1@1	1@23
		CP	2@0	2@23	1@0	1@24	25@0	13@6	1@1	1@23
	30	DFT-s	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		CP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	60	DFT-s	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		CP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10MHz	15	DFT-s	2@0	2@50	1@0	1@51	50@0	25@12	1@1	1@50
		CP	2@0	2@50	1@0	1@51	52@0	26@13	1@1	1@50
	30	DFT-s	2@0	2@22	1@0	1@23	24@0	12@6	1@1	1@22
		CP	2@0	2@22	1@0	1@23	24@0	12@6	1@1	1@22
	60	DFT-s	2@0	2@9	1@0	1@10	10@0	5@2[1]	1@1	1@9
		CP	2@0	2@9	1@0	1@10	11@0	5@2[1]	1@1	1@9
15MHz	15	DFT-s	2@0	2@77	1@0	1@78	75@0	36@18	1@1	1@77
		CP	2@0	2@77	1@0	1@78	79@0	39@19[1]	1@1	1@77
	30	DFT-s	2@0	2@36	1@0	1@37	36@0	18@9	1@1	1@36
		CP	2@0	2@36	1@0	1@37	38@0	19@9	1@1	1@36
	60	DFT-s	2@0	2@16	1@0	1@17	18@0	9@4	1@1	1@16
		CP	2@0	2@16	1@0	1@17	18@0	9@4	1@1	1@16
20MHz	15	DFT-s	2@0	2@104	1@0	1@105	100@0	50@25	1@1	1@104
		CP	2@0	2@104	1@0	1@105	106@0	53@26	1@1	1@104
	30	DFT-s	2@0	2@49	1@0	1@50	50@0	25@12	1@1	1@49
		CP	2@0	2@49	1@0	1@50	51@0	25@12[1]	1@1	1@49
	60	DFT-s	2@0	2@22	1@0	1@23	24@0	12@6	1@1	1@22
		CP	2@0	2@22	1@0	1@23	24@0	12@6	1@1	1@22

NOTE 1: The allocated RB number L_{CRB} is ceil(N_{RB}/2) -1 in order to meet Inner RB allocation definition ($RB_{Start,Low} \leq RB_{Start} \leq RB_{Start,High}$) described in subclause 6.2.2 of TS 38.101-1 [5].

6.2 Transmitter power

6.2.1 UE maximum output power

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Addition to applicability spec is pending

- Initial condition and call setup procedure to support NR satellite access are to be updated

- Message exceptions specific to satellite access is to be updated

- Annex F MU/TT is to be updated

- Verification of UE frequency pre-compensation is to be updated

6.2.1.1 Test purpose

To verify that the error of the UE maximum output power does not exceed the range prescribed by the specified nominal maximum output power and tolerance.

An excess maximum output power has the possibility to interfere to other channels or other systems. A small maximum output power decreases the coverage area.

6.2.1.2 Test applicability

This test case applies to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.2.1.3 Minimum conformance requirements

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

Table 6.2.1.3-1: UE Power Class

NR satellite band	Class 3 (dBm)	Tolerance (dB)
n256	23	±2
n255	23	±2
NOTE 1: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance NOTE 2: Power class 3 is default power class unless otherwise stated		

The normative reference for this requirement is TS 38.101-5 [11] clause 6.2.1.

6.2.1.4 Test description

6.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table table 6.2.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.2.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [12] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for maximum output power test case	**Modulation (NOTE 2)**	**RB allocation (NOTE 1)**
1		DFT-s-OFDM Pi/2 BPSK	Inner Full
2		DFT-s-OFDM Pi/2 BPSK	Inner 1RB Left
3		DFT-s-OFDM Pi/2 BPSK	Inner 1RB Right
4		DFT-s-OFDM QPSK	Inner Full
5		DFT-s-OFDM QPSK	Inner 1RB Left
6		DFT-s-OFDM QPSK	Inner 1RB Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports Pi/2 BPSK in FR1.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, and G.3.1.

4. The UL Reference Measurement Channel is set according to Table 6.2.1.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through AT commands or any other preconfigured means.
7. Test equipment shall emulate Zero Doppler conditions in service link and Common TA delay according to SIB19 configuration in TS 38.508-1 [12].
8. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.2.1.4.3.

6.2.1.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.2.1.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.
3. Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of one active sub-frame (1 ms) and in the uplink symbols. For TDD symbols with transient periods are not under test.

6.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and 5.4 with the following exceptions.

Table 6.2.1.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [12], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

6.2.1.5 Test requirement

The maximum output power, derived in step 3 shall be within the range prescribed by the nominal maximum output power and tolerance in Table 6.2.1.5-1 for Power Class 3.

Table 6.2.1.5-1: Maximum Output Power test requirement for Power Class 3

NR satellite band	Class 3 (dBm)	Tolerance (dB)
n256	23	±(2+TT)
n255	23	±(2+TT)
NOTE 1: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance NOTE 2: Power class 3 is default power class unless otherwise stated NOTE 3: TT for each frequency and channel bandwidth is specified in Table 6.2.1.5-2		

Table 6.2.1.5-2: Test Tolerance (UE maximum output power)

TBD

6.2.2 UE maximum output power reduction

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Addition to applicability spec is pending

- Initial condition and call setup procedure to support NR satellite access is to be updated

- Message exceptions specific to satellite access is to be updated

- Annex F MU/TT is to be updated

- Verification of UE frequency pre-compensation is to be updated

6.2.2.1 Test purpose

The number of RB identified in Table 6.2.2.3-1 is based on meeting the requirements for adjacent channel leakage ratio and the maximum power reduction (MPR) due to Cubic Metric (CM).

6.2.2.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

NOTE: Test execution is not necessary if TS 38.521-5 clause 6.5.2.4.1 is executed.

6.2.2.3 Minimum conformance requirements

UE is allowed to reduce the maximum output power due to higher order modulations and transmit bandwidth configurations. For UE power class 3, the allowed maximum power reduction (MPR) is defined in Table 6.2.2.3-1 for channel bandwidths ≤ 100 MHz. The ΔMPR is set to zero.

The allowed MPR for SRS, PUCCH formats 0, 1, 3 and 4, and PRACH shall be as specified for QPSK modulated DFT-s-OFDM of equivalent RB allocation. The allowed MPR for PUCCH format 2 shall be as specified for QPSK modulated CP-OFDM of equivalent RB allocation.

Table 6.2.2.3-1: Maximum power reduction (MPR) for power class 3

Modulation		MPR (dB)		
		Edge RB allocations	Outer RB allocations	Inner RB allocations
DFT-s-OFDM	Pi/2 BPSK	≤ 0.5		0
	Pi/2 BPSK w Pi/2 BPSK DMRS	≤ 0.5	0	
	QPSK	≤ 1		0
	16 QAM	≤ 2		≤ 1
	64 QAM	≤ 2.5		
	256 QAM	≤ 4.5		
CP-OFDM	QPSK	≤ 3		≤ 1.5
	16 QAM	≤ 3		≤ 2
	64 QAM	≤ 3.5		
	256 QAM	≤ 6.5		

RB allocation ranges for Outer and Inner RB allocations are specified in TS 38.521-1 [2] 6.2.2.3.

The normative reference for this requirement is TS 38.101-5 [11] clause 6.2.2.

6.2.2.4 Test description

6.2.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in

Table 6.2.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in TS 38.521-1 [2] Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in TS 38.521-1 [2] Annex C.2.

Table 6.2.2.4.1-1: Test Configuration Table for power class 3 (contiguous allocation)

Initial Conditions				
Test Environment as specified in TS 38.508-1 [12] subclause 4.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1			Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1			Lowest, Highest	
Test SCS as specified in Table 5.3.5-1			Lowest, Highest	
Test Parameters for Channel Bandwidths				
Test ID	**Freq**	**Downlink Configuration**	**Uplink Configuration**	
			Modulation (NOTE 2)	**RB allocation (NOTE 1)**
1	Default	N/A for Maximum Power Reduction (MPR) test case	DFT-s-OFDM Pi/2 BPSK	Inner Full
2	Low		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Left
3	High		DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Right
4	Default		DFT-s-OFDM Pi/2 BPSK	Outer Full
5	Default		DFT-s-OFDM QPSK	Inner Full
6	Low		DFT-s-OFDM QPSK	Edge_1RB_Left
7	High		DFT-s-OFDM QPSK	Edge_1RB_Right
8	Default		DFT-s-OFDM QPSK	Outer Full
9	Default		DFT-s-OFDM 16 QAM	Inner Full
10	Low		DFT-s-OFDM 16 QAM	Edge_1RB_Left
11	High		DFT-s-OFDM 16 QAM	Edge_1RB_Right
12	Default		DFT-s-OFDM 16 QAM	Outer Full
13	Low		DFT-s-OFDM 64 QAM	Edge_1RB_Left
14	High		DFT-s-OFDM 64 QAM	Edge_1RB_Right
15	Default		DFT-s-OFDM 64 QAM	Outer Full
16	Low		DFT-s-OFDM 256 QAM	Edge_1RB_Left
17	High		DFT-s-OFDM 256 QAM	Edge_1RB_Right
18	Default		DFT-s-OFDM 256 QAM	Outer Full
19	Default		CP-OFDM QPSK	Inner Full
20	Low		CP-OFDM QPSK	Edge_1RB_Left
21	High		CP-OFDM QPSK	Edge_1RB_Right
22	Default		CP-OFDM QPSK	Outer Full
23	Default		CP-OFDM 16 QAM	Inner Full
24	Low		CP-OFDM 16 QAM	Edge_1RB_Left
25	High		CP-OFDM 16 QAM	Edge_1RB_Right
26	Default		CP-OFDM 16 QAM	Outer Full
27	Low		CP-OFDM 64 QAM	Edge_1RB_Left
28	High		CP-OFDM 64 QAM	Edge_1RB_Right
29	Default		CP-OFDM 64 QAM	Outer Full
30	Low		CP-OFDM 256 QAM	Edge_1RB_Left
31	High		CP-OFDM 256 QAM	Edge_1RB_Right
32	Default		CP-OFDM 256 QAM	Outer Full
33[3]	Low		DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Left
34[3]	High		DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Right
35[3]	Default		DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports Pi/2 BPSK in FR1. NOTE 3: Applicable to UEs indicating support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.2.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, and G.3.1.

4. The UL Reference Measurement Channel is set according to Table 6.2.2.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through AT commands or any other preconfigured means.
7. Test equipment shall emulate Zero Doppler conditions in service link and Common TA delay according to SIB19 configuration in TS 38.508-1 [12].
8. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.2.2.4.3.

6.2.2.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.2.2.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms for the UE to reach P_{UMAX} level.
3. Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration of 1 ms over consecutive active uplink slots.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 6.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [12] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and 5.4 with the following exceptions:

Table 6.2.2.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [12] subclause 4.6.3 Table 4.6.3-118 PUSCH-Config			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType0		Almost contiguous allocation
	resourceAllocationType1		Contiguous allocation
}			

Table 6.2.2.4.3-2: DMRS-UplinkConfig Test ID 33 - 35 in Table 6.2.2.4.1-1

Derivation Path: TS 38.508-1 [12], Table 4.6.3-51			
Information Element	**Value/remark**	**Comment**	**Condition**
DMRS-UplinkConfig ::= SEQUENCE {			
transformPrecodingEnabled SEQUENCE {			
dmrs-UplinkTransformPrecoding-r16 SEQUENCE {			
pi2BPSK-ScramblingID0	Not present		
pi2BPSK-ScramblingID1	Not present		
}			
}			
}			

Table 6.2.2.4.3-3: ServingCellConfig

Derivation Path: TS 38.508-1 [12] Table 4.6.3-167			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfig ::= SEQUENCE {			
uplinkConfig SEQUENCE {			
powerBoostPi2BPSK	0		
}			
}			

6.2.2.5 Test requirement

The maximum output power, derived in step 3 shall be within the range prescribed by the nominal maximum output power and tolerance in Table 6.2.2.5-1.

Table 6.2.2.5-1: UE MPR test requirements for power class 3 (contiguous allocation)

Test ID	$P_{PowerClass}$ (dBm)	$\Delta P_{PowerClass}$ (dB)	MPR (dB)	$\Delta T_{C,c}$ (dB)	$P_{CMAX\_L,f,c}$ (dBm)	$T(P_{CMAX\_L,f,c})$ (dB)	$T_{L,c}$ (dB)	Upper limit (dBm)	Lower limit (dBm)
1	23	0	0	0	23.0	2.0	2	25.0 + TT	21.0 - TT
2	23	0	0.5	0	22.5	2.0	2	25.0 + TT	20.5 - TT
3	23	0	0.5	0	22.5	2.0	2	25.0 + TT	20.5 - TT
4	23	0	0.5	0	22.5	2.0	2	25.0 + TT	20.5 - TT
5	23	0	0	0	23.0	2.0	2	25.0 + TT	21.0 - TT
6	23	0	1	0	22.0	2.0	2	25.0 + TT	20.0 - TT
7	23	0	1	0	22.0	2.0	2	25.0 + TT	20.0 - TT
8	23	0	1	0	22.0	2.0	2	25.0 + TT	20.0 - TT
9	23	0	1	0	22.0	2.0	2	25.0 + TT	20.0 - TT
10	23	0	2	0	21.0	2.0	2	25.0 + TT	19.0 - TT
11	23	0	2	0	21.0	2.0	2	25.0 + TT	19.0 - TT
12	23	0	2	0	21.0	2.0	2	25.0 + TT	19.0 - TT
13	23	0	2.5	0	20.5	2.5	2	25.0 + TT	18.0 - TT
14	23	0	2.5	0	20.5	2.5	2	25.0 + TT	18.0 - TT
15	23	0	2.5	0	20.5	2.5	2	25.0 + TT	18.0 - TT
16	23	0	4.5	0	18.5	4.0	2	25.0 + TT	14.5 - TT
17	23	0	4.5	0	18.5	4.0	2	25.0 + TT	14.5 - TT
18	23	0	4.5	0	18.5	4.0	2	25.0 + TT	14.5 - TT
19	23	0	1.5	0	21.5	2.0	2	25.0 + TT	19.5 - TT
20	23	0	3	0	20.0	2.5	2	25.0 + TT	17.5 - TT
21	23	0	3	0	20.0	2.5	2	25.0 + TT	17.5 - TT
22	23	0	3	0	20.0	2.5	2	25.0 + TT	17.5 - TT
23	23	0	2	0	21.0	2.0	2	25.0 + TT	19.0 - TT
24	23	0	3	0	20.0	2.5	2	25.0 + TT	17.5 - TT
25	23	0	3	0	20.0	2.5	2	25.0 + TT	17.5 - TT
26	23	0	3	0	20.0	2.5	2	25.0 + TT	17.5 - TT
27	23	0	3.5	0	19.5	3.5	2	25.0 + TT	16.0 - TT
28	23	0	3.5	0	19.5	3.5	2	25.0 + TT	16.0 - TT
29	23	0	3.5	0	19.5	3.5	2	25.0 + TT	16.0 - TT
30	23	0	6.5	0	16.5	5.0	2	25.0 + TT	11.5 - TT
31	23	0	6.5	0	16.5	5.0	2	25.0 + TT	11.5 - TT
32	23	0	6.5	0	16.5	5.0	2	25.0 + TT	11.5 - TT
33	23	0	0.5	0	22.5	2.0	2	25.0 + TT	20.5 - TT
34	23	0	0.5	0	22.5	2.0	2	25.0 + TT	20.5 - TT
35	23	0	0	0	23	2.0	2	25.0 + TT	21.0 - TT

NOTE 1: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance.
NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.2.2.5-2.

Table 6.2.2.5-2: Test Tolerance (Maximum Power Reduction (MPR))

[to be updated]

6.2.3 UE additional maximum output power reduction

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Addition to applicability spec is pending

- Initial condition and call setup procedure to support NR satellite access are to be updated

- Message exceptions specific to satellite access is to be updated

- Annex F MU/TT is to be updated

6.2.3.1 Test purpose

Additional emission requirements can be signalled by the network. Each additional emission requirement is associated with a unique network signalling (NS) value indicated in RRC signalling by an NR frequency band number of the applicable operating band and an associated value in the field *additionalSpectrumEmission*. Throughout this specification, the notion of indication or signalling of an NS value refers to the corresponding indication of an NR satellite band number of the applicable operating band, the IE field *freqBandIndicatorNR* and an associated value of *additionalSpectrumEmission* in the relevant RRC information elements [8].

To meet the additional requirements, additional maximum power reduction (A-MPR) is allowed for the maximum output power as specified in Table 6.2.1.3-1. Unless stated otherwise, the total reduction to UE maximum output power is max(MPR, A-MPR) where MPR is defined in clause 6.2.2. Outer and inner allocation notation used in clause 6.2.3 is defined in clause 6.2.2. In absence of modulation and waveform types the A-MPR applies to all modulation and waveform types.

6.2.3.2 Test applicability

[to be updated]

6.2.3.3 Minimum conformance requirements

6.2.3.3.1 General

Table 6.2.3.3.1-1 specifies the additional requirements with their associated network signalling values and the allowed A-MPR and applicable operating band(s) for each NS value. The mapping of NR satellite band numbers and values of the *additionalSpectrumEmission* to network signalling labels is specified in Table 6.2.3.3.1-2.

Table 6.2.3.3.1-1: Additional maximum power reduction (A-MPR)

Network signalling label	Requirements (clause)	NR satellite Band	Channel bandwidth (MHz)	Resources blocks (N_{RB})	A-MPR (dB)
NS_01		Table 5.2.2-1	5, 10, 15, 20	Table 5.3.2-1	N/A
NS_24	6.5.3.3.13 in 3GPP TS 38.101-1 [5]	n256	5, 10, 15, 20	Table 6.2.3.15-1 in 3GPP TS 38.101-1 [5]	Clause 6.2.3.15 in 3GPP TS 38.101-1 [5][2]
NS_02N	6.5.3.3.3.1	n255	5, 10, 15, 20		N/A
NS_100	6.5.2.4.2 in 3GPP TS 38.101-1 [5]	n256[1]			Table 6.2.3.1-2 in 3GPP TS 38.101-1 [5]
NOTE 1: This NS can be signalled for NR bands that have UTRA services deployed. NOTE 2: A-MPR for the upper 5 MHz of the band is not specified, and therefore shall be used as a guard band.					

[The NS_01 label with the field *additionalPmax* [8] absent is default for all NTN satellite bands.]

Table 6.2.3.3.1-2: Mapping of network signalling label

NR satellite band	Value of additionalSpectrumEmission							
	0	1	2	3	4	5	6	7
n256	NS_01	NS_24	NS_100					
n255	NS_01	NS_02N						
NOTE: *additionalSpectrumEmission* corresponds to an information element of the same name defined in clause 6.3.2 of 3GPP TS 38.331 [8].								

Table 6.2.3.3.1-3: A-MPR for NS_100 (UTRA protection)

Modulation/Waveform		Outer (dB)
DFT-s-OFDM	Pi/2 BPSK	≤ 2
	QPSK	≤ 2
	16 QAM	≤ 2.5
	64 QAM	≤ 3
	256 QAM	≤ 4.5
CP-OFDM	QPSK	≤ 4
	16 QAM	≤ 4
	64 QAM	≤ 4
	256 QAM	≤ 6.5

The normative reference for this requirement is TS 38.101-5 [11] clause 6.2.3.1.

6.2.3.3.2 A-MPR for NS_24

Table 6.2.3.3.2-1: A-MPR regions for NS_24

Channel Bandwidth, MHz	Carrier Centre Frequency, Fc, MHz	Region A		Region B		Region C	
		RB_{end}*12* SCS MHz	L_{CRB}*12* SCS MHz	RB_{end}*12*S CS MHz	L_{CRB}*12* SCS MHz	RB_{end}*12*S CS MHz	L_{CRB}*12* SCS MHz
5MHz	Fc=1,992.5		>3.24				
5MHz	Fc=1,997.5		>3.24				
5MHz	Fc=2,002.5		>2.16	>3.78	≤1.98	≤3.6	≤1.98
10MHz	Fc=1,985	>5.4					
10MHz	Fc=1,995		>4.5	>7.56	≤4.32	≤7.38	≤4.32
10MHz	Fc=2,000	>6.84		<2.88		≥3.06 ≤6.66	>1.44
15MHz	Fc=1,987.5		>7.02	>11.52	≤6.84	≤11.34	≤6.84
15MHz	Fc=1,997.5	>9.36		<3.6		≥3.78 ≤9.18	>1.44
20MHz	Fc=1,990	>13.5		<4.5		≥4.68 ≤13.32	>2.16
20MHz	Fc=1,995	>12.6		<5.4		≥5.58 ≤12.42	>1.44
NOTE 1: The A-MPR values are listed in Table 6.2.3.3.2-2. NOTE 2: For any undefined region, MPR applies							

Table 6.2.3.3.2-2: A-MPR for NS_24

Modulation/Waveform		Outer (dB)	Inner (dB)
DFT-s-OFDM	PI/2 BPSK	≤ 1.5	N/A
	QPSK	≤ 2	
	16 QAM	≤ 3	
	64 QAM	≤ 3.5	
	256 QAM	≤ 5.5	
CP-OFDM	QPSK	≤ 4	
	16 QAM	≤ 4	
	64 QAM	≤ 4.5	
	256 QAM	≤ 7.5	

6.2.3.4 Test description

6.2.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Tables 6.2.3.4.1-1 to 6.2.3.4.1-30. The details of the uplink reference measurement channels (RMCs) are specified in clause A.2. Configurations of PDSCH and PDCCH before measurement are specified in clause C.2.

Table 6.2.3.4.1-1: Test Configuration table for NS_100

Initial Conditions							
Test Environment as specified in TS 38.508-1 [12] subclause 4.1							Normal
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1							Low range, High range
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1							Lowest, Highest
Test SCS as specified in Table 5.3.5-1							Lowest, Highest
A-MPR test parameters for NS_100							
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**		
					Modulation (Note 2)		**RB allocation (Note 1)**
1	Low	Default	Default	N/A for A-MPR test cases	DFT-s OFDM	Pi/2 BPSK	Edge_1RB_Left
2	High	Default	Default			Pi/2 BPSK	Edge_1RB_Right
3	Default	Default	Default			Pi/2 BPSK	Outer_Full
4	Low	Default	Default			QPSK	Edge_1RB_Left
5	High	Default	Default			QPSK	Edge_1RB_Right
6	Default	Default	Default			QPSK	Outer_Full
7	Low	Default	Default			16 QAM	Edge_1RB_Left
8	High	Default	Default			16 QAM	Edge_1RB_Right
9	Default	Default	Default			16 QAM	Outer_Full
10	Low	Default	Default			64 QAM	Edge_1RB_Left
11	High	Default	Default			64 QAM	Edge_1RB_Right
12	Default	Default	Default			64 QAM	Outer_Full
13	Low	Default	Default			256 QAM	Edge_1RB_Left
14	High	Default	Default			256 QAM	Edge_1RB_Right
15	Default	Default	Default			256 QAM	Outer_Full
16	Low	Default	Default		CP-s OFDM	QPSK	Edge_1RB_Left
17	High	Default	Default			QPSK	Edge_1RB_Right
18	Default	Default	Default			QPSK	Outer_Full
19	Low	Default	Default			16 QAM	Edge_1RB_Left
20	High	Default	Default			16 QAM	Edge_1RB_Right
21	Default	Default	Default			16 QAM	Outer_Full
22	Low	Default	Default			64 QAM	Edge_1RB_Left
23	High	Default	Default			64 QAM	Edge_1RB_Right
24	Default	Default	Default			64 QAM	Outer_Full
25	Low	Default	Default			256 QAM	Edge_1RB_Left
26	High	Default	Default			256 QAM	Edge_1RB_Right
27	Default	Default	Default			256 QAM	Outer_Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table. NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports Pi/2 BPSK in FR1.							

Table 6.2.3.4.1-2: Test Configuration table for NS_24

Initial Conditions								
Test Environment as specified in TS 38.508-1 [12] subclause 4.1				Normal				
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1				Refer to uplink carrier centre frequency (F_c) in test parameters				
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1				Refer to test parameters (5, 10, 15, 20 MHz)				
Test SCS as specified in Table 5.3.5-1				Lowest				
A-MPR test parameters for NS_24								
Test ID	**F_c (MHz)**	**ChBw (MHz)**	**SCS**	**Downlink Configuration**	**Uplink Configuration**			
					Modulation (NOTE 2, 3)		**RB allocation (Note 1)**	
							Region A	**Region B**	**Region C**
1-5	1,992.5	5	Default	N/A for A-MPR testing	DFT-s OFDM	Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A

6-10	1,997.5	5	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
11-25	2,002.5	5	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	Edge_1RB_Right	Edge_1RB_Left
26-30	1,985	10	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	N/A	N/A
31-35	1,985	10	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
36-50	1,995	10	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	Edge_1RB_Right	Edge_1RB_Left
51-65	2,000	10	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	Edge_1RB_Left	36@0
66-70	2,000	10	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
71-85	1,987.5	15	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	Edge_1RB_Right	Edge_1RB_Left
86-100	1,997.5	15	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	Edge_1RB_Left	50@0
101-105	1,997.5	15	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
106-120	1,990	20	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	Edge_1RB_Left	74@0
121-125	1,990	20	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A

126-140	1,995	20	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	Edge_1RB_Left	69@0
141-145	1,995	20	Default			Pi/2 BPSK QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
146-149	1,992.5	5	Default		CP-OFDM	QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
150-153	1,997.5	5	Default			QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
154-165	2,002.5	5	Default			QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	Edge_1RB_Right	Edge_1RB_Left
166-169	1,985	10	Default			QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	N/A	N/A
170-173	1,985	10	Default			QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
174-185	1,995	10	Default			QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	Edge_1RB_Right	Edge_1RB_Left
186-197	2,000	10	Default			QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	Edge_1RB_Left	37@0
198-201	2,000	10	Default			QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
202-213	1,987.5	15	Default			QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	Edge_1RB_Right	Edge_1RB_Left
214-225	1,997.5	15	Default			QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	Edge_1RB_Left	51@0
226-229	1,997.5	15	Default			QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
230-241	1,990	20	Default			QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	Edge_1RB_Left	74@0
242-245	1,990	20	Default			QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
246-257	1,995	20	Default			QPSK 16 QAM 64 QAM 256 QAM	Edge_1RB_Right	Edge_1RB_Left	69@0

258-261	1,995	20	Default			QPSK 16 QAM 64 QAM 256 QAM	Outer_Full	N/A	N/A
262	1,992.5	5	Default			QPSK	Edge_1RB_Right	N/A	N/A
263	1,997.5	5	Default			16 QAM	Edge_1RB_Right	N/A	N/A
264	1,985	10	Default			QPSK	Edge_1RB_Left	N/A	N/A
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 unless otherwise stated in this table. NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports Pi/2 BPSK in FR1. NOTE 3: In test IDs with multiple modulations, each UL Modulation shall be tested separately against Range A, B, and C.									

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2 and uplink signals according Annex G.0, G.1, G.2 and G.3.1.
4. The UL Reference Measurement channels are set according to the applicable table from Table 6.2.3.4.1-1 to Table 6.2.3.4.1-2.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.2.3.4.3.

6.2.3.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to the applicable table from Table 6.2.3.4.1-1 to Table 6.2.3.4.1-2. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE Allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.
3. Measure the mean power of the UE in the channel bandwidth of the radio access mode. The period of measurement shall be at least the continuous duration one sub-frame (1 ms).

NOTE: When switching to DFT-s-OFDM waveform, as specified in the test configuration Table 6.2.3.4.1-1 to Table 6.2.3.4.1-2, send an NR RRCReconfiguration message according to TS 38.508-1 [12] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.2.3.4.3 Message contents

6.2.3.4.3.1 Message contents exceptions for network signalling value "NS_100"

1. Information element additionalSpectrumEmission is set to NS_100. This can be set in the *SIB1* as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 6.2.3.4.3.1-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_100"

Derivation Path: TS 38.508-1 [12], Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	2 (NS_100)		

6.2.3.4.3.2 Message contents exceptions for network signalling value "NS_24"

1. Information element additionalSpectrumEmission is set to NS_24. This can be set in the *SIB1* as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 6.2.3.4.3.2-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_24"

Derivation Path: TS 38.508-1 [12], Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_24)		

6.2.3.5 Test requirement

The maximum output power, derived in step 3 shall be within the range prescribed by the nominal maximum output power and tolerance in the applicable Table from table 6.2.3.5-1 to Table 6.2.3.5-3. The allowed A-MPR values specified in Table 6.2.3.3.1-1 are in addition to the allowed MPR requirements specified in clause 6.2.2. For the UE maximum output power modified by MPR and/or A-MPR, the power limits specified in Table 6.2.1.3-1 apply.

Table 6.2.3.5-1: Test Tolerance (UE additional maximum output power reduction)

[to be updated]

Table 6.2.3.5-2: UE Power Class 3 test requirements (NS_100) for n256

Test ID	$P_{PowerClass}$ (dBm)	MPR (dB)	A-MPR (dB)	$\Delta T_{C,c}$ (dB)	$P_{CMAX\_L,c}$ (dBm)	$T(P_{CMAX\_L,c})$ (dB)	$T_{L,c}$ (dB)	Upper limit (dBm)	Lower limit (dBm)
1, 2	23	0.5	2	0	21	2	2	25+TT	19-TT
3	23	0.5	2	0	21	2	2	25+TT	19-TT
4, 5	23	1	2	0	21	2	2	25+TT	19-TT
6	23	1	2	0	21	2	2	25+TT	19-TT
7, 8	23	2	2.5	0	20.5	2.5	2	25+TT	18-TT
9	23	2	2.5	0	20.5	2.5	2	25+TT	18-TT
10, 11	23	2.5	3	0	20	2.5	2	25+TT	17.5-TT
12	23	2.5	3	0	20	2.5	2	25+TT	17.5-TT
13, 14	23	4.5	4.5	0	18.5	4	2	25+TT	14.5-TT
15	23	4.5	4.5	0	18.5	4	2	25+TT	14.5-TT
16, 17	23	3	4	0	19	3.5	2	25+TT	15.5-TT
18	23	3	4	0	19	3.5	2	25+TT	15.5-TT
19, 20	23	3	4	0	19	3.5	2	25+TT	15.5-TT
21	23	3	4	0	19	3.5	2	25+TT	15.5-TT
22, 23	23	3.5	4	0	19	3.5	2	25+TT	15.5-TT
24	23	3.5	4	0	19	3.5	2	25+TT	15.5-TT
25, 26	23	6.5	6.5	0	16.5	5	2	25+TT	11.5-TT
27	23	6.5	6.5	0	16.5	5	2	25+TT	11.5-TT
NOTE 1: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.2.3.5-1.									

Table 6.2.3.5-3: UE Power Class 3 test requirements (NS_24) for n256

Test ID	$P_{PowerClass}$ (dBm)	MPR (dB)	A-MPR (dB)	$\Delta T_{C,c}$ (dB)	$P_{CMAX\_L,c}$ (dBm)	$T(P_{CMAX\_L,c})$ (dB)	$T_{L,c}$ (dB)	Upper limit (dBm)	Lower limit (dBm)
1, 6, 11-13, 26, 31, 36-38, 51-53, 66, 71-73, 86-88, 101, 106-108, 121, 126-128, 141	23	N/A	1.5	0	21.5	2	2	25+TT	19.5-TT
2, 7, 14-16, 27, 32, 39-41, 54-56, 67, 74-76, 89-91, 102, 109-111, 122, 129-131, 142	23	N/A	2.0	0	21	2	2	25+TT	19-TT
3, 8, 17-19, 28, 33, 42-44, 57-59, 68, 77-79, 92-94, 103, 112-114, 123, 132-134, 143	23	N/A	3.0	0	20	2.5	2	25+TT	17.5-TT
4, 9, 20-22, 29, 34, 45-47, 60-62, 69, 80-82, 95-97, 104, 115-117, 124, 135-137, 144	23	N/A	3.5	0	19.5	3.5	2	25+TT	16-TT
5, 10, 23-25, 30, 35, 48-50, 63-65, 70, 83-85, 98-100, 105, 118-120, 125, 138-140, 145	23	N/A	5.5	0	17.5	5	2	25+TT	12.5-TT

Test ID	$P_{PowerClass}$ (dBm)	MPR (dB)	A-MPR (dB)	$\Delta T_{C,c}$ (dB)	$P_{CMAX\_L,c}$ (dBm)	$T(P_{CMAX\_L,c})$ (dB)	$T_{L,c}$ (dB)	Upper limit (dBm)	Lower limit (dBm)
146-147, 150-151, 154-159, 166-167, 170-171, 174-179, 186-191, 198-199, 202-207, 214-219, 226-227, 230-235, 242-243, 246-251, 258-259, 262-264	23	N/A	4	0	19	3.5	2	25+TT	15.5-TT
148, 152, 160-162, 168, 172, 180-182, 192-194, 200, 208-210, 220-222, 228, 236-238, 244, 252-254, 260	23	N/A	4.5	0	18.5	4	2	25+TT	14.5-TT
149, 153, 163-165, 169, 173, 183-185, 195-197, 201, 211-213, 223-225, 229, 239-241, 245, 255-257, 261	23	N/A	7.5	0	15.5	5	2	25+TT	10.5-TT
NOTE 1: $P_{PowerClass}$ is the maximum UE power specified without taking into account the tolerance. NOTE 2: TT for each frequency and channel bandwidth is specified in Table 6.2.3.5-1.									

6.2.4 Configured transmitted power

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Addition to applicability spec is pending

- Initial condition and call setup procedure to support NR satellite access are to be updated

- Message exceptions specific to satellite access is to be updated

- Annex F MU/TT is to be updated

6.2.4.1 Test purpose

To verify the measured UE configured maximum output power $P_{UMAX,f,c}$ is within the specified bounds.

6.2.4.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.2.4.3 Minimum conformance requirements

The requirements for configured transmitted power defined in subclause 6.2.4 of 3GPP TS 38.521-1 [2] clause 6.2.4 shall apply to NTN satellite UE.

The normative reference for this requirement is TS 38.101-1 [5] clause 6.2.4.

6.2.4.4 Test description

6.2.4.4.1 Initial condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.2.4.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in clause A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.2.4.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [12] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation (NOTE 2)**	**RB allocation (NOTE 1)**
1		DFT-s-OFDM Pi/2 BPSK	Inner Full
2		DFT-s-OFDM QPSK	Inner Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1. NOTE 2: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.2.4.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause [to be updated] is provided to the UE through AT commands or any other preconfigured means.
7. Test equipment shall emulate Zero Doppler conditions in service link and Common TA delay according to SIB19 configuration in TS 38.508-1 [12].
8. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.2.4.4.3.

6.2.4.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.2.4.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step to ensure that the UE reaches the Pumax level of the test point.

3. Measure the mean power of the UE in the channel bandwidth for each test point in table 6.2.4.5-1 according to the test configuration from table 6.2.4.4.1-1. The period of measurement shall be at least the continuous duration of one active slot and in the uplink symbols. For TDD slots with transient periods are not under test.

6.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 with the following exceptions:

Table 6.2.4.4.3-0: *PUSCH-Config*

Derivation Path: TS 38.508-1 [12], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

Table 6.2.4.4.3-1: FrequencyInfoUL-SIB: Test point 1

Derivation Path: TS 38.508-1 [12] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	-10		

Table 6.2.4.4.3-2: FrequencyInfoUL-SIB: Test point 2

Derivation Path: TS 38.508-1 [12] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	10		

Table 6.2.4.4.3-3: FrequencyInfoUL-SIB: Test point 3

Derivation Path: TS 38.508-1 [12] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	15		

Table 6.2.4.4.3-4: FrequencyInfoUL-SIB: Test point 4

Derivation Path: TS 38.508-1 [12] Table 4.6.3-62 FrequencyInfoUL-SIB			
Information Element	**Value/remark**	**Comment**	**Condition**
p-Max	20		

Table 6.2.4.4.3-5: ServingCellConfig

Derivation Path: TS 38.508-1 [12] Table 4.6.3-167			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfig ::= SEQUENCE {			
uplinkConfig SEQUENCE {			
powerBoostPi2BPSK	0		Test ID 1, 2
}			
}			

6.2.4.5 Test requirement

The maximum output power measured shall not exceed the values specified in Table 6.2.4.5-1.

Table 6.2.4.5-1: P_{CMAX} configured UE output power for Test ID 1,2

	Maximum output power
Measured UE output power test point 1	-10 dBm ± (7+TT)
Measured UE output power test point 2	10 dBm ± (6+TT)
Measured UE output power test point 3	15 dBm ± (5+TT)
Measured UE output power test point 4	Note 3
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.2.4.5-2. NOTE 2: Power class 3 is default power class unless otherwise stated. NOTE 3: The maximum output power shall be within the range in Table 6.2.4.5-1a.	

Table 6.2.4.5-1a: Measured UE output power test point 4 for Test ID 1,2

NR band	**Tolerance (dB)**
n256	20 dBm ±(2.5+TT)
n255	20 dBm ±(2.5+TT)
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.2.4.5-2.	

Table 6.2.4.5-2: Test Tolerance (Configured transmitted power)

[to be updated]

6.3 Output power dynamics

6.3.1 Minimum output power

6.3.1.1 Test purpose

To verify the UE's ability to transmit with a broadband output power below the value specified in the test requirement when the power is set to a minimum value.

6.3.1.2 Test applicability

This test case applies to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.3.1.3 Minimum conformance requirements

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

The minimum output power is defined as the mean power in at least one sub-frame 1 ms. The minimum output power shall not exceed the values specified in Table 6.3.1.3-1.

Table 6.3.1.3-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
5	-40	4.515
10	-40	9.375
15	-40	14.235
20	-40	19.095

The normative reference for this requirement is TS 38.101-5 [11] clause 6.3.1.

6.3.1.4 Test description

6.3.1.4.1 Initial condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in table 6.3.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [12] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for minimum output power test case	**Modulation**	**RB allocation (NOTE 1)**
1		DFT-s-OFDM QPSK	Outer Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to clauses C.0, C.1, C.2, and uplink signals according to clauses G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.3.1.4.1-1.
5. Propagation conditions are set according to Annex B.0.

6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through AT commands or any other preconfigured means.

7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508-1 [12] table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508[12] clause 5.6.3.1.

8. Deactivate UE prediction of satellite trajectory by any preconfigured means.

9. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.3.1.4.3.

6.3.1.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3.1.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send continuously uplink power control "down" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step to ensure that the UE transmits at its minimum output power.

3. Measure the mean power of the UE in the associated measurement channel bandwidth specified in Table 6.3.1.5-1 for the specific channel bandwidth under test. The period of measurement shall be at least the continuous duration of one active sub-frame (1 ms) and in the uplink symbols. For TDD symbols with transient periods are not under test.

6.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 with following exception.

Table 6.3.1.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [12], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

6.3.1.5 Test requirement

The minimum output power, derived in step 3 shall not exceed the values specified in Table 6.3.1.5-1.

Table 6.3.1.5-1: Minimum output power

Channel bandwidth (MHz)	Minimum output power (dBm)	Measurement bandwidth (MHz)
5	-40+TT	4.515
10	-40+TT	9.375
15	-40+TT	14.235
20	-40+TT	19.095
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3.1.5-2		

Table 6.3.1.5-2: Test Tolerance (Minimum output power)

	f ≤ 3.0GHz
BW ≤ 40MHz	1 dB

6.3.2 Transmit OFF power

6.3.2.1 Test purpose

To verify that the UE transmit OFF power is lower than the value specified in the test requirement.

An excess Transmit OFF power potentially increases the Rise Over Thermal (RoT) and therefore reduces the cell coverage area for other UEs.

6.3.2.2 Test applicability

This test case applies to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.3.2.3 Minimum conformance requirements

Transmit OFF power is defined as the mean power in the channel bandwidth when the transmitter is OFF. The transmitter is considered OFF when the UE is not allowed to transmit on any of its ports.

The Transmit OFF power is defined as the mean power in a duration of at least one sub-frame (1 ms) excluding any transient periods. The Transmit OFF power shall not exceed the values specified in Table 6.3.2.3-1.

Table 6.3.2.3-1: Transmit OFF power

Channel bandwidth	(MHz)	5, 10, 15, 20
REF_SCS	(kHz)	15
Transmit OFF power	(dBm)	-50
Measurement bandwidth	(MHz)	MBW=REF_SCS*(12*N_{RB}+1)/1000

The normative reference for this requirement is TS 38.101-5 [11] clause 6.3.2.

6.3.2.4 Test description

This test is covered by clause 6.3.3 Transmit ON/OFF time mask.

6.3.2.5 Test requirement

The requirement for the Transmit OFF power shall not exceed the values specified in Table 6.3.2.5-1.

Table 6.3.2.5-1: Transmit OFF power

Channel bandwidth (MHz)	Transmit OFF power (dBm)	Measurement bandwidth (MHz)
5	-50+TT	4.515
10	-50+TT	9.375
15	-50+TT	14.235
20	-50+TT	19.095
NOTE 1: TT for each frequency and channel bandwidth is specified in Table 6.3.2.5-2		

Table 6.3.2.5-2: Test Tolerance (Transmit OFF power)

	f ≤ 3.0GHz
BW ≤ 40MHz	1.5 dB

6.3.3 Transmit on/off time mask

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Annex F MU/TT is to be updated

6.3.3.1 Test purpose

To verify that the general ON/OFF time mask meets the requirements given in 6.3.3.5.

The transmit power time mask for transmit ON/OFF defines the transient period(s) allowed between transmit OFF power as defined in sub-clause 6.3.2 and transmit ON power symbols (transmit ON/OFF)

Transmission of the wrong power increases interference to other channels or increases transmission errors in the uplink channel.

6.3.3.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.3.3.3 Minimum conformance requirements

The requirements for transmit ON/OFF time mask defined in 3GPP TS 38.101-1 [5] clause 6.3.3 shall apply for NTN satellite UE.

The normative reference for this requirement is TS 38.101-5 [11] clause 6.2.2.

6.3.3.4 Test description

6.3.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 6.3.3.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.3.3.4.1-1: Test Configuration Table for power class 3

Initial Conditions			
Test Environment as specified in TS 38.508-1 [12] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters for Channel Bandwidths			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1)**
1		DFT-s-OFDM QPSK	Inner Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.NOTE 2: Void.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to TS 38.521-1 [2] clauses G.0, G.1, G.2, and G.3.1.
4. The UL Reference Measurement Channel is set according to Table 6.3.3.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through AT commands or any other preconfigured means.

7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] Table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and Table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1

8. Deactivate UE prediction of satellite trajectory by any preconfigured means.

9.. Ensure the UE is in State [to be updated] with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.3.3.4.3.

6.3.3.4.2 Test procedure

1. SS sends uplink scheduling information via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.3.3.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC. The UL assignment is such that the UE transmits on slots 8 for15 kHz SCS, on slots 8 and 18 for 30 kHz SCS and on slots 17 and 37 for 60 kHz SCS.

2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE; allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

3. ON power sub test:

   3.1. Measure the output power of the UE PUSCH transmission during one slot.

4. OFF power sub test:

   4.1. Measure the UE transmission OFF power during the slot prior to the PUSCH transmission, excluding a transient period of 10 µs in the end of the slot.

   4.2. Measure the UE transmission OFF power during the slot following the PUSCH transmission, excluding a transient period of 10 µs at the beginning of the slot.

6.3.3.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6with the following exceptions: SIB19 message contents according to TS 38.508-1 [12] clause 5.6.2.1. In addition the below message contents needs to be configured.

Table 6.3.3.4.3-1: PUSCH-TimeDomainResourceAllocationList

Derivation Path: TS 38.508-1 [**12**], Table 4.6.3-122			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE(1..maxNrofUL-Allocations)) OF {	2 entries		
PUSCH-TimeDomainResourceAllocation[1] SEQUENCE {			
k2	4		FR1_15kHz, FR1_30kHz
	6		FR1_60kHz

mappingType	typeA		
startSymbolAndLength	27	Start symbol(S)=0, Length(L)=14	
}			
PUSCH-TimeDomainResourceAllocation[2] SEQUENCE {		Addressed by Msg3 PUSCH time resource allocation field of the Random Access Response acc. to TS 38.213 [7] Table 8.2-1.	
k2	2	K_2+ Δ=4 acc. to TS 38.214 [16] Table 6.1.2.1.1-5 (NOTE 1)	FR1_15kHz
	6	K_2+ Δ=9 acc. to TS 38.214 [16] Table 6.1.2.1.1-5 (NOTE 1)	FR1_30kHz
mappingType	typeA		
startSymbolAndLength	27	Start symbol(S)=0, Length(L)=14	
}			
}			
NOTE 1: Values are chosen so that first slot of a TDD-UL-DL slot configuration period can be used for the Random Access Response and the last slot (of the same or another period) for the corresponding Msg3.			

Condition	Explanation
FR1_15kHz	FR1 is used under the test. SCS is set to 15kHz.
FR1_30kHz	FR1 is used under the test. SCS is set to 30kHz.
FR1_60kHz	FR1 is used under the test. SCS is set to 60kHz.

Table 6.3.3.4.3-2: *PUSCH-Config*

Derivation Path: TS 38.508-1 [12], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

Table 6.3.3.4.3-3: *P-Max*

Derivation Path: TS 38.508-1 [12], Table 4.6.3-89			
Information Element	**Value/remark**	**Comment**	**Condition**
P-Max	23		

6.3.3.5 Test requirement

The requirement for the power measured in steps 2, 3 and 4 of the test procedure shall not exceed the values specified in Table 6.3.3.5-1.

Table 6.3.3.5-1: General ON/OFF time mask

	Channel bandwidth / minimum output power / measurement bandwidth			
	5MHz	**10MHz**	**15MHz**	**20MHz**
Transmit OFF power	≤ -50+TT dBm			
Transmission OFF Measurement bandwidth	4.515	9.375	14.235	19.095
Transmit ON power	Same as Table 6.2.1.5-1			
NOTE 1: TT for each frequency and channel bandwidth of OFF power is specified in Table 6.3.3.5-2 NOTE 2: TT for each frequency and channel bandwidth of ON power is specified in Table 6.2.1.5-2				

Table 6.3.3.5-2: Test Tolerance for OFF power

	f ≤ 3.0GHz
BW ≤ 40MHz	[to be updated]

6.4 Transmit signal quality

6.4.1 Frequency error

6.4.1_1 Frequency error with GSO ephemeris

6.4.1_1.1 Test purpose

This test verifies the ability of both, the receiver and the transmitter, to process frequency correctly.

Receiver: to extract the correct frequency from the stimulus signal, offered by the System simulator, under ideal propagation conditions and low level.

Transmitter: to derive the correct modulated carrier frequency from the results, gained by the receiver.

6.4.1_1.2 Test applicability

This test case applies to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation and GSO.

6.4.1_1.3 Minimum conformance requirements

The NTN satellite UE basic measurement interval of modulated carrier frequency is 1 UL slot. The NTN satellite UE pre-compensates the uplink modulated carrier frequency by the estimated Doppler shift according to 3GPP TS 38.300 [9] clause 16.14.2. The mean value of basic measurements of NTN UE modulated carrier frequency shall be accurate to within ± 0.1 PPM observed over a period of 1 ms of cumulated measurement intervals compared to ideally pre-compensated reference uplink carrier frequency.

[NOTE: The ideally pre-compensated reference uplink carrier frequency consists of the UL carrier frequency signalled to the UE by SAN and UL pre-compensated Doppler frequency shift. For the test case, the location of the UE is explicitly provided to the UE from the test equipment.]

The normative reference for this requirement is TS 38.101-5 [11] clause 6.4.1.

6.4.1_1.4 Test description

6.4.1_1.4.1 Initial condition

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 6.4.1_1.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in TS 38.521-1 [2] Annexe A.2. Configurations of PDSCH and PDCCH before measurement are specified in TS 38.521-1 Annex C.2.

Table 6.4.1_1.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [12] subclause 4.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1			Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1			Highest	
Test SCS as specified in Table 5.3.5-1			Lowest	
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Modulation**	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (NOTE 1)	DFT-s-OFDM QPSK	REFSENS (NOTE 2)
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2 NOTE 2: REFSENS refers to Table 7.3.2.4.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, in Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.0.

4. The DL and UL Reference Measurement channels are set according to Table 6.4.1_1.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. UE location for GSO according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through any preconfigured means.

7. Deactivate UE prediction of satellite trajectory by any preconfigured means.

6.4.1_1.4.2 Test procedure

1. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] table 5.6.2.1-1. Test system shall send same SIB19 information during the duration of this frequency error measurement as defined in TS 38.508-1 [12] clause 5.6.3.1.

2. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On, Test Mode On and Test Loop Function On according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.4.1_1.4.3.

3. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 6.4.1_1.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

4. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.4.1_1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

5. Set the Downlink signal level to the appropriate REFSENS value defined in Table 7.3.2.5-1. Send continuously uplink power control "up" commands to the UE in every uplink scheduling information to the UE so that the UE transmits at P_{UMAX} level for the duration of the test. Allow at least 200 ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

6. Measure the Frequency Error using Global In-Channel Tx-Test (Annex E). For TDD, only slots consisting of only UL symbols are under test.

7. Repeat from test procedure steps 1-6 with ephemeris values for maximum positive Doppler replacing ephemeris in step 1 by Table 6.4.1_1.4.3-1a. Test system shall send same SIB19 information during the duration of this frequency error measurement.

8. Repeat from test procedure steps 1-6 with ephemeris values for maximum negative Doppler replacing ephemeris in step 1 by Table 6.4.1_1.4.3-2a. Test system shall send same SIB19 information during the duration of each frequency error measurement.

9. Repeat from test procedure steps 1-6 with ephemeris values for half of maximum positive Doppler replacing ephemeris in step1 by Table 6.4.1_1.4.3-3a. Test system shall send same SIB19 information during the duration of this frequency error measurement.

6.4.1_1.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and subclause 5.6.2.1 with the following exceptions:

Table 6.4.1_1.4.3-1a: SIB19 for RF tests with NR NTN Ephemeris Information for GSO satellites (maximum positive Doppler)

Derivation Path: TS 38.508-1, Table 5.6.3.1-1			
Information Element	**Value/remark**	**Comment**	**Condition**
SIB19-r17 ::= SEQUENCE {			
ntn-Config-r17 SEQUENCE {			
cellSpecificKoffset-r17	264		
EphemerisInfo-r17 CHOICE {			
positionVelocity-r17 SEQUENCE {			
positionX-r17	-17104941		
positionY-r17	27550229		
positionZ-r17	-607219		
velocityVX-r17	258		
velocityVY-r17	299		
velocityVZ-r17	6277		
}			
}			
}			
}			
NOTE 1: Satellite-UE elevation angle equal to 26.15 degrees, one-way delay equal to 129.93 ms and Doppler equal to 0.17 ppm			

Table 6.4.1_1.4.3-1b: Void

Table 6.4.1_1.4.3-2a: SIB19 for RF tests with NNR NTN Ephemeris Information for GSO satellites (maximum negative Doppler)

Derivation Path: TS 38.508-1, Table 5.6.3.1-1			
Information Element	**Value/remark**	**Comment**	**Condition**
SIB19-r17 ::= SEQUENCE {			
ntn-Config-r17 SEQUENCE {			
cellSpecificKoffset-r17	264		
EphemerisInfo-r17 CHOICE {			
positionVelocity-r17 SEQUENCE {			
positionX-r17	-17061001		
positionY-r17	27582763		
positionZ-r17	-276165		
velocityVX-r17	361		
velocityVY-r17	160		
velocityVZ-r17	-6335		
}			
}			
}			
}			
NOTE 1: Satellite-UE elevation angle equal to 26.78 degrees, one-way delay equal to 129.74 ms and Doppler equal to -0.17 ppm.			

Table 6.4.1_1.4.3-2b: Void

Table 6.4.1_1.4.3-3a: SIB19 for RF tests with NR NTN Ephemeris Information for GSO satellites (maximum positive Doppler/2)

Derivation Path: TS 38.508-1, Table 5.6.3.1-1			
Information Element	**Value/remark**	**Comment**	**Condition**
SIB19-r17 ::= SEQUENCE {			
ntn-Config-r17 SEQUENCE {			
cellSpecificKoffset-r17	264		
EphemerisInfo-r17 CHOICE {			
positionVelocity-r17 SEQUENCE {			
positionX-r17	-17062164		
positionY-r17	27354696		
positionZ-r17	-3544856		
velocityVX-r17	-360		
velocityVY-r17	164		
velocityVZ-r17	2993		
}			
}			
}			
}			
NOTE 1: Satellite-UE elevation angle equal to 20.61 degrees, one-way delay equal to 131.70 ms and Doppler equal to -0.085 ppm.			

Table 6.4.1.4.3-3b: Void

6.4.1_1.5 Test requirement

The frequency error Δf shall fulfil the test requirement:

$|\Delta f| \leq (0.1 \text{ PPM} + [15 \text{ Hz}])$

The above requirement shall be verified for at least two cases of which one has zero Doppler conditions.

6.4.1_2 Frequency error with NGSO ephemeris

6.4.1_2.1 Test purpose

Same test purpose as in clause 6.4.1_1.1.

6.4.1_2.2 Test applicability

This test case applies to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation and NGSO.

6.4.1_2.3 Minimum conformance requirements

Same minimum conformance requirements as in clause 6.4.1_1.3.

6.4.1_2.4 Test description

6.4.1_2.4.1 Initial condition

Same initial conditions as in clause 6.4.1_1.4.1 with the following exception:

- In step 6, instead of UE location for GSO satellite → use UE location for NGSO satellite

6.4.1_2.4.2 Test procedure

Same test procedure as in clause 6.4.1_1.4.2 with the following exceptions:

- In step 1, instead of TS 38.508-1 [12] Table 5.6.2.1-1 → use TS 38.508-1 [12] Table 5.6.2.1-3 (ephemeris for NGSO LEO 1200).
- Instead of Tables 6.4.1_1.4.3-1a, 6.4.1_1.4.3-2a, and 6.4.1_1.4.3-3a → use Tables 6.4.1_2.4.3-1, 6.4.1_2.4.3-2, and 6.4.1_2.4.3-3, respectively.
- If the UE supports GSO and NGSO, skip steps 1 to 6 of the test procedure and start with step 7.

6.4.1_2.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and subclause 5.6.2.1 with the following exceptions

Table 6.4.1_2.4.3-1: SIB19 for RF tests with NR NTN Ephemeris Information for NGSO (LEO-600) satellites (maximum positive Doppler)

Derivation Path: TS 38.508-1, Table 5.6.3.1-1			
Information Element	**Value/remark**	**Comment**	**Condition**
EphemerisInfo-r17 ::= CHOICE {			
positionVelocity-r17 SEQUENCE {			
positionX-r17	-2717617		
positionY-r17	4550419		
positionZ-r17	852799		
velocityVX-r17	6164		
velocityVY-r17	-19424		
velocityVZ-r17	124281		
}			
}			
NOTE 1: Satellite-UE elevation angle equal to 10 degrees, one-way delay equal to 6.44 ms and Doppler equal to 22.65 ppm.			

Table 6.4.1_2.4.3-2: SIB19 for RF tests with NR NTN Ephemeris Information for NGSO (LEO-600) satellites (maximum negative Doppler)

Derivation Path: TS 38.508-1, Table 5.6.3.1-1			
Information Element	**Value/remark**	**Comment**	**Condition**
EphemerisInfo-r17 ::= CHOICE {			
positionVelocity-r17 SEQUENCE {			
positionX-r17	-2199272		
positionY-r17	3404229		
positionZ-r17	3535794		
velocityVX-r17	35394		
velocityVY-r17	-74414		
velocityVZ-r17	94682		
}			
}			
NOTE 1: Satellite-UE elevation angle equal to 169.97 degrees, one-way delay equal to 6.60 ms and Doppler equal to -22.62 ppm.			

Table 6.4.1_2.4.3-3: SIB19 for RF tests with NR NTN Ephemeris Information for NGSO (LEO-600) satellites (maximum positive Doppler/2)

Derivation Path: TS 38.508-1, Table 5.6.3.1-1			
Information Element	**Value/remark**	**Comment**	**Condition**
EphemerisInfo-r17 ::= CHOICE {			
positionVelocity-r17 SEQUENCE {			
positionX-r17	-2592823		
positionY-r17	4245650		
positionZ-r17	2024520		
velocityVX-r17	19359		
velocityVY-r17	-43278		
velocityVZ-r17	116553		
}			
}			
NOTE 1: Satellite-UE elevation angle equal to 60.25 degrees, one-way delay equal to 2.30 ms and Doppler equal to 11.29 ppm.			

6.4.1_2.5 Test requirement

The frequency error Δf shall fulfil the test requirement:

$|\Delta f| \leq (0.1\ \text{PPM} + [15\ \text{Hz}])$

The above requirement shall be verified for at least two cases of which one has zero Doppler conditions.

6.5 Output RF spectrum emissions

[to be updated]

6.5.1 Occupied bandwidth

[to be updated]

6.5.2 Out of band emission

6.5.2.1 [to be updated]

6.5.2.2 Spectrum emission mask

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Annex F MU/TT is to be updated

6.5.2.2.1 Test purpose

To verify that the power of any UE emission shall not exceed specified level for the specified channel bandwidth

6.5.2.2.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.5.2.2.3 Minimum conformance requirements

The spectrum emission mask of the UE applies to frequencies (Δf_{OOB}) starting from the ± edge of the assigned NR channel bandwidth. For frequencies offset greater than Δf_{OOB}, the spurious requirements in clause 6.5.3 are applicable.

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.

The power of any UE emission shall not exceed the levels specified in Table 6.5.2.2.3-1 for the specified channel bandwidth.

Table 6.5.2.2.3-1: General NR spectrum emission mask

Δf_{OOB} (MHz)	Channel bandwidth (MHz) / Spectrum emission limit (dBm)		Measurement bandwidth
	5	10, 15, 20	
± 0-1	-13	-13	1 % of channel BW
± 1-5	-10	-10	1 MHz
± 5-6	-13		
± 6-10	-25		
± 5-$BW_{Channel}$		-13	
± $BW_{Channel}$-($BW_{Channel}$+5)		-25	

The normative reference for this requirement is TS 38.101-5 [11] clause 6.5.2.2.

6.5.2.2.4 Test description

6.5.2.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 6.5.2.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in TS 38.521-1 [2] Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in TS 38.521-1 [2] Annex C.2.

Table 6.5.2.2.4.1-1: Test Configuration Table for power class 3 (contiguous allocation)

Default Conditions						
Test Environment as specified in TS 38.508-1 [12] subclause 4.1					Normal	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1					Low range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1					Lowest, Highest	
Test SCS as specified in Table 5.3.5-1					Lowest, Highest	
Test Parameters for Channel Bandwidths						
Test ID	**Freq**	**ChBw**	**SCS**	**Downlink Configuration**	**Uplink Configuration**	
		Default	Default	N/A for Spectrum Emission Mask test case	**Modulation (NOTE 2)**	**RB allocation (NOTE 1)**
1[4]	Low				DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Left
2[4]	High				DFT-s-OFDM Pi/2 BPSK	Edge_1RB_Right
3[4]	Default				DFT-s-OFDM Pi/2 BPSK	Outer_Full
4	Low				DFT-s-OFDM QPSK	Edger_1RB_Left

5	High				DFT-s-OFDM QPSK	Edge_1RB_Right
6	Default				DFT-s-OFDM QPSK	Outer_Full
7	Low				DFT-s-OFDM 16 QAM	Edge_1RB_Left
8	High				DFT-s-OFDM 16 QAM	Edge_1RB_Right
9	Default				DFT-s-OFDM 16 QAM	Outer_Full
10	Low				DFT-s-OFDM 64 QAM	Edge_1RB_Left
11	High				DFT-s-OFDM 64 QAM	Edge_1RB_Right
12	Default				DFT-s-OFDM 64 QAM	Outer_Full
13	Low				DFT-s-OFDM 256 QAM	Edge_1RB_Left
14	High				DFT-s-OFDM 256 QAM	Edge_1RB_Right
15	Default				DFT-s-OFDM 256 QAM	Outer_Full
16	Low				CP-OFDM QPSK	Edge_1RB_Left
17	High				CP-OFDM QPSK	Edge_1RB_Right
18	Default				CP-OFDM QPSK	Outer_Full
19	Low				CP-OFDM 16 QAM	Edge_1RB_Left
20	High				CP-OFDM 16 QAM	Edge_1RB_Right
21	Default				CP-OFDM 16 QAM	Outer_Full
22	Low				CP-OFDM 64 QAM	Edge_1RB_Left
23	High				CP-OFDM 64 QAM	Edge_1RB_Right
24	Default				CP-OFDM 64 QAM	Outer_Full
25	Low				CP-OFDM 256 QAM	Edge_1RB_Left
26	High				CP-OFDM 256 QAM	Edge_1RB_Right
27	Default				CP-OFDM 256 QAM	Outer_Full
28[5,6]	Low				DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Left
29[5,6]	High				DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Edge_1RB_Right
30[5,6]	Default				DFT-s-OFDM Pi/2 BPSK w Pi/2 BPSK DMRS	Outer Full

NOTE 1: The specific configuration of each RF allocation is defined in Table 6.1-1.
NOTE 2: DFT-s-OFDM Pi/2 BPSK test applies only for UEs which supports Pi/2 BPSK in FR1.
NOTE 3: VOID
NOTE 4: UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79, or in TDD mode the IE *powerBoostPi2BPSK* is set to 0 for bands n40, n41, n77, n78 and n79.
NOTE 5: For Power Class 3 testing, UE operating in FDD mode, or in TDD mode in bands other than n40, n41, n77, n78 and n79, or in TDD mode the IE *powerBoostPi2BPSK* is set to 0 for bands n40, n77, n78 and n79.
NOTE 6: Applicable to UEs indicating support for UE capability *lowPAPR-DMRS-PUSCHwithPrecoding-r16*.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, and G.3.1.

4. The UL Reference Measurement Channel is set according to Table 6.2.2.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through AT commands or any other preconfigured means.

7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] Table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and Table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1

8. Deactivate UE prediction of satellite trajectory by any preconfigured means.

9. Ensure the UE is in State [to be updated] with generic procedure parameters [to be updated], Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.2.2.4.3.

6.5.2.2.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.2.2.4.1-1, Table 6.5.2.2.4.1-2, Table 6.5.2.2.4.1-2a and Table 6.5.2.2.4.1-3. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send continuously power control "up" commands to the UE until the UE transmits at PUMAX level. Allow at least 200 ms for the UE to reach PUMAX level.

3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, which shall meet the requirements described in Tables 6.2.2.5-1 to 6.2.2.5-9. The period of the measurement shall be at least the continuous duration of 1 ms over consecutive active uplink slots. For TDD, only slots consisting of only UL symbols are under test.

4. Measure the power of the transmitted signal with a measurement filter of bandwidths according to table 6.5.2.2.5-1. The centre frequency of the filter shall be stepped in continuous steps according to the same table. The measured power shall be recorded for each step. The measurement period shall capture the active TSs.

NOTE 1: When switching to DFT-s-OFDM waveform, as specified in the test configuration table 6.5.2.2.4.1-1, send an NR RRCReconfiguration message according to TS 38.508-1 [12] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [12] clause 4.6 ensuring Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED for NR band.

Message contents are according to TS 38.508-1 [12] subclause 4.6 with the following exceptions: SIB19 message contents according to TS 38.508-1 [12] clause 5.6.2.1. In addition the below *PUSCH-Config* IE needs to be configured.

Table 6.5.2.2.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [12] subclause 4.6.3 Table 4.6.3-118 PUSCH-Config			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType0		Almost contiguous allocation
	resourceAllocationType1		Contiguous allocation
}			

Table 6.5.2.2.4.3-2: DMRS-UplinkConfig (Test ID 28 – 30 in Table 6.5.2.2.4.1-1)

Derivation Path: TS 38.508-1 [12], Table 4.6.3-51			
Information Element	**Value/remark**	**Comment**	**Condition**
DMRS-UplinkConfig ::= SEQUENCE {			
transformPrecodingEnabled SEQUENCE {			
dmrs-UplinkTransformPrecoding-r16 SEQUENCE {			
pi2BPSK-ScramblingID0	Not present		
pi2BPSK-ScramblingID1	Not present		
}			
}			
}			

6.5.2.2.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in Tables 6.2.2.5-1, and the power of any UE emission shall fulfil requirements in Table 6.5.2.2.5-1.

Table 6.5.2.2.5-1: General NR spectrum emission mask

Δf_{OOB} (MHz)	**Channel bandwidth (MHz) / Spectrum emission limit (dBm)**		**Measurement bandwidth**
	5	**10, 15, 20**	
± 0-1	-13+TT	-13+TT	1 % of channel BW
± 1-5	-10+TT	-10+TT	1 MHz
± 5-6	-13+TT		
± 6-10	-25+TT		
± 5-$BW_{Channel}$		-13+TT	
± $BW_{Channel}$-($BW_{Channel}$+5)		-25+TT	

Table 6.5.2.2.5-2: Test Tolerance (Spectrum Emission Mask)

[to be updated]

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.

6.5.2.3 [to be updated]

6.5.2.4 Adjacent channel leakage ratio

6.5.2.4.0 General

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.

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.

6.5.2.4.1 NR Adjacent channel leakage ratio

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Annex F MU/TT is to be updated

6.5.2.4.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR).

6.5.2.4.1.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.5.2.4.1.3 Minimum conformance requirements

NR Adjacent Channel Leakage power Ratio (NR_{ACLR}) is the ratio of the filtered mean power centred on the assigned NR channel frequency to the filtered mean power centred on an adjacent NR channel frequency at nominal channel spacing.

The assigned NR channel power and adjacent NR channel power are measured with rectangular filters with measurement bandwidths specified in Table 6.5.2.4.1.3-1.

If the measured adjacent channel power is greater than –50 dBm then the NR_{ACLR} shall be higher than the value specified in Table 6.5.2.4.1.3-2.

Table 6.5.2.4.1.3-1: NR ACLR measurement bandwidth

Channel bandwidth	(MHz)	5,10,15,20
REF_SCS	(kHz)	15
NR ACLR measurement bandwidth	(MHz)	MBW=REF_SCS*(12*N_{RB}+1)/1000

Table 6.5.2.4.1.3-2: NR ACLR requirement

	Power class 3
NR ACLR	30 dB

The normative reference for this requirement is TS 38.101-5 [11] clause 6.5.2.4.1.

6.5.2.4.1.4 Test description

6.5.2.4.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 6.2.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.2.4.1.4.1-1: Void

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.2.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to clauses C.0, C.1, C.2, and uplink signals according to TS 38.521-1 [2] clauses G.0, G.1, G.2, and G.3.1.
4. The UL Reference Measurement Channel is set according to Table 6.5.2.2.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through AT commands or any other preconfigured means.
7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] Table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and Table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1
8. Deactivate UE prediction of satellite trajectory by any preconfigured means.
9. Ensure the UE is in State [to be updated] with generic procedure parameters according to TS 38.508-1 [12] clause [to be updated], Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.5.2.4.1.4.3.

6.5.2.4.1.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to the test configuration tables in clause 6.2.2.4.1T. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
2. Send continuously power control "up" commands to the UE until the UE transmits at P_{UMAX} level. Allow at least 200 ms for the UE to reach P_{UMAX} level.
3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration, as measured in step 3 of 6.2.2.4.2, which shall meet the requirements described in clause 6.2.2.5 as appropriate.
4. Measure the rectangular filtered mean power for the assigned NR channel.
5. Measure the rectangular filtered mean power of the first NR adjacent channel on both lower and upper side of the assigned NR channel, respectively.
6. Calculate the ratios of the power between the values measured in step 4 over step 5 for lower and upper NR ACLR, respectively.

NOTE: When switching to DFT-s-OFDM waveform, as specified in the test configuration tables in clause 6.2.2.4.1, send an NR RRCReconfiguration message according to TS 38.508-1 [12] clause 4.6.3 Table 4.6.3-118 PUSCH-Config with TRANSFORM_PRECODER_ENABLED condition.

6.5.2.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and 5.4 with the following exceptions:

SIB19 message contents according to TS 38.508-1 [12] clause 5.6.2.1. In addition the below message contents needs to be configured.

Table 6.5.2.4.1.4.3-1: *P-Max* (Step 7)

Derivation Path: TS 38.508-1 [12], Table 4.6.3-89			
Information Element	**Value/remark**	**Comment**	**Condition**
P-Max	23		PC2 UE or PC1 UE

Table 6.5.2.4.1.4.3-1a: Void

Table 6.5.2.4.1.4.3-2: *PUSCH-Config*

Derivation Path: TS 38.508-1 [12] subclause 4.6.3 Table 4.6.3-118 PUSCH-Config			
Information Element	**Value/remark**	**Comment**	**Condition**
PUSCH-Config ::= SEQUENCE {			
resourceAllocation	resourceAllocationType0		Almost contiguous allocation
	resourceAllocationType1		Contiguous allocation
}			

Table 6.5.2.4.1.4.3-3: DMRS-UplinkConfig (Test ID 28-30 in Table 6.5.2.2.4.1-1)

Derivation Path: TS 38.508-1 [12], Table 4.6.3-51			
Information Element	**Value/remark**	**Comment**	**Condition**
DMRS-UplinkConfig ::= SEQUENCE {			
transformPrecodingEnabled SEQUENCE {			
dmrs-UplinkTransformPrecoding-r16 {			
Setup SEQUENCE {			
pi2BPSK-ScramblingID0	Not present		
pi2BPSK-ScramblingID1	Not present		
}			
}			
}			
}			

Table 6.5.2.4.1.4.3-4: ServingCellConfig

Derivation Path: TS 38.508-1 [12] Table 4.6.3-167			
Information Element	**Value/remark**	**Comment**	**Condition**
ServingCellConfig ::= SEQUENCE {			
uplinkConfig SEQUENCE {			
powerBoostPi2BPSK	0		
}			
}			

6.5.2.4.1.5 Test requirement

The measured UE mean power in the channel bandwidth, derived in step 3, shall fulfil requirements in clause 6.2.2.5 as appropriate, and if the measured adjacent channel power is greater than –50 dBm then the measured NR ACLR, derived in step 6, shall be higher than the limits in Table 6.5.2.4.1.5-2.

Table 6.5.2.4.1.5-1: NR ACLR measurement bandwidth

Channel bandwidth	(MHz)	5,10,15,20
REF_SCS	(kHz)	15
NR ACLR measurement bandwidth	(MHz)	MBW=REF_SCS*(12*N_{RB}+1)/1000

Table 6.5.2.4.1.5-2: NR ACLR requirement

	Power class 3
NR ACLR	30 - TT dB

Table 6.5.2.4.1.5-3: Test Tolerance (NR ACLR)

[to be updated]

6.5.2.4.2 UTRA Adjacent channel leakage ratio

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Addition to applicability spec is pending
- Initial condition and call setup procedure to support NR satellite access is to be updated
- Message exceptions specific to satellite access is to be updated
- Test Points analysis is to be updated
- Test configuration is to be updated
- Annex F MU/TT is to be updated

6.5.2.4.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to adjacent channels in terms of Adjacent Channel Leakage power Ratio (ACLR).

6.5.2.4.2.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.5.2.4.2.3 Minimum conformance requirements

UTRA adjacent channel leakage power ratio ($UTRA_{ACLR}$) is the ratio of the filtered mean power centred on the assigned NR channel frequency to the filtered mean power centred on an adjacent(s) UTRA channel frequency.

$UTRA_{ACLR}$ is specified for the first adjacent UTRA channel ($UTRA_{ACLR1}$) which center frequency is ± 2.5 MHz from NR channel edge and for the 2nd adjacent UTRA channel ($UTRA_{ACLR2}$) which center frequency is ± 7.5 MHz from NR channel edge.

The UTRA channel power is measured with a RRC filter with roll-off factor α = 0.22 and bandwidth of 3.84 MHz. The assigned NR channel power is measured with a rectangular filter with measurement bandwidth specified in Table 6.5.2.4.1.3-1.

If the measured adjacent channel power is greater than – 50 dBm then the $UTRA_{ACLR1}$ and $UTRA_{ACLR2}$ shall be higher than the value specified in Table 6.5.2.4.2.3-1.

Table 6.5.2.4.2.3-1: UTRA ACLR requirement

	Power class 3
$UTRA_{ACLR1}$	33 dB
$UTRA_{ACLR2}$	36 dB

UTRA ACLR requirement is applicable when signalled by the network with network signalling value indicated by the field *additionalSpectrumEmission*.

The normative reference for this requirement is TS 38.101-5 [11] clause 6.5.2.4.2.

6.5.2.4.2.4 Test description

6.5.2.4.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 6.2.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.2.4.2.4.1-1: Test Configuration Table for power class 3

[to be updated]

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.2.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to TS 38.521-1 [2] clauses G.0, G.1, G.2, and G.3.1.
4. The UL Reference Measurement Channel is set according to Table 6.5.2.2.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.5.2.4.2.4.3.

6.5.2.4.2.4.2 Test procedure

[to be updated]

6.5.2.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and 5.4 with the following exceptions:

[to be updated]

6.5.2.4.2.5 Test requirement

[to be updated]

6.5.3 Spurious emission

6.5.3.0 General

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 in line with SM.329 [15] and NTN 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.

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.

6.5.3.1 General spurious emissions

6.5.3.1.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions.

6.5.3.1.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.5.3.1.3 Minimum conformance requirements

This clause specifies the requirements for the specified NR NTN satellite bands for Transmitter Spurious emissions requirement with frequency range as indicated in Table 6.5.3.1.3-2.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth. The spurious emission limits in Table 6.5.3.1.3-2 apply for all transmitter band configurations (N_{RB}) and channel bandwidths.

Table 6.5.3.1.3-1: Boundary between NR out of band and general spurious emission domain

Channel bandwidth	OOB boundary F_{OOB} (MHz)
$BW_{Channel}$	$BW_{Channel}$ + 5

Table 6.5.3.1.3-2: Requirement for general spurious emissions limits

Frequency Range	Maximum Level	Measurement bandwidth	NOTE
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1,000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	

The normative reference for this requirement is TS 38.101-5 [11] subclause 6.5.3.1

6.5.3.1.4 Test description

6.5.3.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 6.5.3.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.3.1.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [12] subclause 4.1.		Normal	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1.		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1.		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for Spurious Emissions testing	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	OuterFull
2		CP-OFDM QPSK	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1 and C.2, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.
4. The UL Reference Measurement channels are set according to Table 6.5.3.1.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through AT commands or any other preconfigured means.
7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1.
8. Deactivate UE prediction of satellite trajectory by any preconfigured means.
9. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.5.3.1.4.3.

6.5.3.1.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.3.1.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5.3.1.5-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 6.5.3.1.5-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6.

6.5.3.1.5 Test requirement

This clause specifies the requirements for the specified NR band for Transmitter Spurious emissions requirement with frequency range as indicated in Table 6.5.3.1.5-1.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth. The spurious emission limits in Table 6.5.3.1.5-1 apply for all transmitter band configurations (N_{RB}) and channel bandwidths.

The measured average power of spurious emission, derived in step 3, shall not exceed the described value in Table 6.5.3.1.5-1.

Table 6.5.3.1.5-1: General spurious emissions test requirements

frequency Range	Maximum Level	Measurement bandwidth	NOTE
9 kHz ≤ f < 150 kHz	-36 dBm	1 kHz	
150 kHz ≤ f < 30 MHz	-36 dBm	10 kHz	
30 MHz ≤ f < 1,000 MHz	-36 dBm	100 kHz	
1 GHz ≤ f < 5th harmonic of the upper frequency edge of the UL operating band in GHz	-30 dBm	1 MHz	

6.5.3.2 Spurious emissions for UE co-existence

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Addition to applicability spec is pending

- Initial condition and call setup procedure to support NR satellite access are to be updated

- Message exceptions specific to satellite access is to be updated

- Annex F MU/TT is to be updated

6.5.3.2.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to co-existing systems for the specified bands which has specific requirements in terms of transmitter spurious emissions.

6.5.3.2.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.5.3.2.3 Minimum conformance requirements

This clause specifies the requirements for NR NTN satellite bands for UE coexistence with protected bands.

Table 6.5.3.2.3-1: Requirements for spurious emissions for UE co-existence

NR NTN satellite Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
n255	NR Band n1, n2, n3, n5, n7, n8, n12, n13, n14, n18, n20, n24, n25, n26, n28, n29, n30, n34, n38, n39, n40, n41, n48, n50, n51, n53, n65, n66, n67, n70, n71, n74, n75, n76, n85, n90, n91, n92, n93, n94, n100, n101	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
n256	NR Band n1, n3, n5, n7, n8, n12, n13, n14, n18, n20, n24, n26, n28, n29, n30, n38, n39, n40, n41, n48, n50, n51, n53, n54, n65, n66, n67, n71, n74, n75, n76, n78, n79, n85, n90, n91, n92, n93, n94, n100, n101	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 33, 35	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	NR Band n2, n25, n70	F_{DL_low}	-	F_{DL_high}	NA	NA	3
NOTE 1: The protected NR or E-UTRA bands are specified in clause 5.2 from 3GPP TS 38.101-1 [5] or 3GPP TS 36.101 [10]. F_{DL_low} and F_{DL_high} refer to each frequency band specified in Table 5.2.-1 in 3GPP TS 38.101-1 [5] or 3GPP TS 36.101 [10].							
NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1.3-2 are permitted for each assigned NR 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 (2 MHz + N x L_{CRB} x RB_{size} kHz), 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: The co-existence between n256 and band n2, n25 and n70 is subject to regional/national regulation.							

NOTE: To simplify Table 6.5.3.2.3-1, NR band numbers are listed for bands which are specified only for NR operation or both E-UTRA and NR operation. E-UTRA band numbers are listed for bands which are specified only for E-UTRA operation.

The normative reference for this requirement is TS 38.101-5 [11] subclause 6.5.3.2.

6.5.3.2.4 Test description

6.5.3.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 6.5.3.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in clause A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.3.2.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [12] subclause 4.1.		Normal	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1.		Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1.		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A	**Modulation**	**RB allocation (NOTE 1)**
1		CP-OFDM QPSK	Outer_Full
2		CP-OFDM QPSK	Edge_1RB_Left
3		CP-OFDM QPSK	Edge_1RB_Right
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1 Common UL configuration.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to clauses C.0, C.1 and C.2, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, and G.3.1.
4. The UL Reference Measurement channels are set according to Table 6.5.3.2.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through any preconfigured means.
7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1.
8. Deactivate UE prediction of satellite trajectory by any preconfigured means.
9. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.5.3.2.4.3.

6.5.3.2.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.3.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.
3. Measure the power of the transmitted signal with a measurement filter of bandwidths according to Table 6.5.3.2.3-1. The centre frequency of the filter shall be stepped in contiguous steps according to Table 6.5.3.2.3-1. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

6.5.3.2.4.3 Message contents

Message contents are according to TS 38.508-1[12] subclause 4.6.

6.5.3.2.5 Test requirement

This clause specifies the requirements for the specified NR band for Transmitter Spurious emissions requirement with frequency range as indicated in Table 6.5.3.2.5-1.

Unless otherwise stated, the spurious emission limits apply for the frequency ranges that are more than F_{OOB} (MHz) in Tables 6.5.3.1.3-1 from the edge of the channel bandwidth. The spurious emission limits in Tables 6.5.3.2.3-1 apply for all transmitter band configurations (N_{RB}) and channel bandwidths.

The measured average power of spurious emission, derived in step 3, shall not exceed the described value in Table 6.5.3.2.5-1.

Table 6.5.3.2.5-1: Requirements for spurious emissions for UE co-existence

NR NTN satellite Band	Spurious emission for UE co-existence						
	Protected band	Frequency range (MHz)			Maximum Level (dBm)	MBW (MHz)	NOTE
n255	NR Band n1, n2, n3, n5, n7, n8, n12, n13, n14, n18, n20, n24, n25, n26, n28, n29, n30, n34, n38, n39, n40, n41, n48, n50, n51, n53, n65, n66, n67, n70, n71, n74, n75, n76, n85, n90, n91, n92, n93, n94, n100, n101	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77, n78, n79	F_{DL_low}	-	F_{DL_high}	-50	1	2
n256	NR Band n1, n3, n5, n7, n8, n12, n13, n14, n18, n20, n24, n26, n28, n29, n30, n38, n39, n40, n41, n48, n50, n51, n53, n65, n66, n67, n71, n74, n75, n76, n78, n79, n85, n90, n91, n92, n93, n94, n101, n100, n101	F_{DL_low}	-	F_{DL_high}	-50	1	
	E-UTRA Band 33, 35, 54	F_{DL_low}	-	F_{DL_high}	-50	1	
	NR Band n77	F_{DL_low}	-	F_{DL_high}	-50	1	2
	NR Band n2, n25, n70	F_{DL_low}	-	F_{DL_high}	NA	NA	3
NOTE 1: The protected NR or E-UTRA bands are specified in clause 5.2 from 3GPP TS 38.101-1 [5] or 3GPP TS 36.101 [10]. F_{DL_low} and F_{DL_high} refer to each frequency band specified in Table 5.2.2-1 in 3GPP TS 38.101-1 [5] or 3GPP TS 36.101 [10].							
NOTE 2: As exceptions, measurements with a level up to the applicable requirements defined in Table 6.5.3.1.3-2 are permitted for each assigned NR 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 (2 MHz + N x L_{CRB} x RB_{size} kHz), 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: The co-existence between n256 and band n2, n25 and n70 is subject to regional/national regulation.							

6.5.3.3 Additional Spurious emissions

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Test configuration is to be updated and test configuration in [Table 6.2.3.4.1-3] is TBD

- Relative power TC Table 6.3.4.3.3-1 is to be updated

6.5.3.3.1 Test purpose

To verify that UE transmitter does not cause unacceptable interference to other channels or other systems in terms of transmitter spurious emissions under the deployment scenarios where additional requirements are specified.

6.5.3.3.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.5.3.3.3 Minimum conformance requirements

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.

The normative reference for this requirement is TS 38.101-5 [11] subclause 6.5.3.3.

6.5.3.3.3.1 Minimum conformance requirements (network signalling value "NS_02N")

When "NS_02N" is indicated in the cell, the power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.3.1-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth.

Table 6.5.3.3.3.1-1: Additional requirements for "NS_02N"

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit[1] (dBm)	Measurement bandwidth	NOTE
	5 MHz, 10 MHz, 15 MHz, 20 MHz		
1,559≤ f ≤ 1,605	-50	700 Hz	Averaged over any 2 millisecond active transmission interval
1,605≤ f ≤ 1,610	-50 + 24/5 (f-1605)	700Hz	
1,559 ≤ f ≤ 1,605	-40	1MHz	Averaged over any 2 millisecond active transmission interval
1,605≤ f ≤ 1,610	-40 + 24/5 (f-1605)	1MHz	
NOTE: The EIRP requirement in regulation is converted to conducted requirement using a 0 dBi antenna.			

6.5.3.3.4 Test description

6.5.3.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All these configurations shall be tested with applicable test parameters for each channel bandwidth and sub-carrier spacing, are shown in Tables 6.5.3.3.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.3.3.4.1-1: Test Configuration Table (network signalling value “NS_02N”)

Same test configuration as listed in [Table 6.2.3.4.1-3] shall be used with the following exceptions:

- Test SCS shall be: No exception for UE mean power testing (step 3) and only Lowest for additional spurious emission testing (step 4)

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1 and C.2, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, and G.3.1.
4. The UL Reference Measurement channels are set according to Table 6.5.3.3.4.1-1.
5. Propagation conditions are set according to Annex B.0.

6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through any preconfigured means.

7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1.

8. Deactivate UE prediction of satellite trajectory by any preconfigured means.

9. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.5.3.1.4.3.

6.5.3.3.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.3.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

2. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE until the UE transmits at P_{UMAX} level.

3. Measure the mean power of the UE in the channel bandwidth of the radio access mode according to the test configuration in Tables 6.5.3.3.4.1-1, which shall meet the requirements in clause 6.5.3.3.5 with allowed A-MPR values specified in 6.2.3.5. The measured power shall be verified for each step. The measurement period shall capture the active time slots.

4. Measure the power of the transmitted signal with a measurement filter of bandwidths according to clauses 6.5.3.3.3.1. The centre frequency of the filter shall be stepped in contiguous steps according to the same table. During measurement the spectrum analyser shall be set to 'Detector' = RMS. For NS_02N the additional spurious emissions requirement shall be verified with UE transmission power obtained by sending uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level 15 dBm for at least the duration of the additional spurious emissions measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW.

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in [Table 6.3.4.3.3-1] and is [0.7dB] for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

6.5.3.3.4.3 Message contents

Message contents for SIB19 are according to TS 38.508-1 [12] clause 5.6.2.1 with following exceptions:

6.5.3.3.4.3.1 Message contents exceptions (network signalling value "NS_02N")

Message contents are according to TS 38.508-1 [12] subclause 4.6, with the following exceptions:

1. Information element additionalSpectrumEmission is set to NS_02N. This can be set in *SIB1* as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 6.5.3.3.4.3.1-1: *AdditionalSpectrumEmission: A*dditional spurious emissions test requirement for "NS_02N"

Derivation Path: TS 38.508-1 [12] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_02N)		

6.5.3.3.5 Test requirement

This clause specifies the requirements for the specified NR band for an additional spectrum emission requirement with protected bands as indicated from Table 6.5.3.3.5.1-1.

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.

6.5.3.3.5.1 Test requirement (network signalling value "NS_02N")

When "NS_02N" is indicated in the cell,

The power of any UE emission shall not exceed the levels specified in Table 6.5.3.3.5.1-1. This requirement also applies for the frequency ranges that are less than F_{OOB} (MHz) in Table 6.5.3.1.3-1 from the edge of the channel bandwidth.

Table 6.5.3.3.5.1-1: Additional requirements for "NS_02N"

Frequency band (MHz)	Channel bandwidth / Spectrum emission limit[1] (dBm)	Measurement bandwidth	NOTE
	5 MHz, 10 MHz, 15 MHz, 20 MHz		
1,559≤ f ≤ 1,605	-50	700 Hz	Averaged over any 2-millisecond active transmission interval
1,605≤ f ≤ 1,610	-50 + 24/5 (f-1605)	700Hz	
1,559 ≤ f ≤ 1,605	-40	1MHz	Averaged over any 2-millisecond active transmission interval
1,605≤ f ≤ 1,610	-40 + 24/5 (f-1605)	1MHz	
NOTE: The EIRP requirement in regulation is converted to conducted requirement using a 0 dBi antenna.			

6.5.4 Transmit intermodulation

6.5.4.1 Test purpose

To verify that the UE transmit intermodulation does not exceed the described value in the test requirement.

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.

6.5.4.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

6.5.4.3 Minimum conformance requirements

UE transmit intermodulation 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 transmitter antenna port with the other antenna port(s) if any terminated. Both the wanted signal power and the intermodulation product power are measured through NR rectangular filter with measurement bandwidth shown in Table 6.5.4.3-1.

The requirement of transmit intermodulation is specified in Table 6.5.4.3-1.

Table 6.5.4.3-1: Transmit Intermodulation

Wanted signal channel bandwidth	$BW_{Channel}$	
Interference signal frequency offset from channel center	$BW_{Channel}$	$2*BW_{Channel}$
Interference CW signal level	-40 dBc	
Intermodulation product	< -29 dBc	< -35 dBc
Measurement bandwidth	The maximum transmission bandwidth configuration among the different SCS's for the channel BW as defined in Table 6.5.2.4.3-1	
Measurement offset from channel center	$BW_{Channel}$ and $2*BW_{Channel}$	$2*BW_{Channel}$ and $4*BW_{Channel}$

The normative reference for this requirement is TS 38.101-5 [11] clause 6.5.4.

6.5.4.4 Test description

6.5.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in table 6.5.4.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexes A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 6.5.4.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [12] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1		Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest, Highest	
Test Parameters			
Test ID	**Downlink Configuration**	**Uplink Configuration**	
	N/A for transmit intermodulation test case	**Modulation**	**RB allocation (NOTE 1)**
1		DFT-s-OFDM Pi/2 BPSK	Inner Full
2		DFT-s-OFDM QPSK	Inner Full
NOTE 1: The specific configuration of each RB allocation is defined in Table 6.1-1.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, in Figure A.3.1.3.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1 in TS 38.521-1 [2].
4. The UL Reference Measurement channels are set according to Table 6.5.4.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through any preconfigured means.
7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and table 5.6.2.1-3 for

NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1.

8. Deactivate UE prediction of satellite trajectory by any preconfigured means.

9. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 6.5.4.4.3.

6.5.4.4.2 Test procedure

1. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.5.4.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2. Send continuously uplink power control "up" commands to the UE until the UE transmits at its P_{UMAX} level.

3. Measure the rectangular filtered mean power of the UE. For TDD, only slots consisting of only UL symbols are under test for the wanted signal and for the intermodulation product.

4. Set the interference signal frequency below the UL carrier frequency using the first offset in table 6.5.4.5-1.

5. Set the interference CW signal level according to table 6.5.4.5-1.

6. Search the intermodulation product signals below and above the UL carrier frequency, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 3.

7. Set the interference signal frequency above the UL carrier frequency using the first offset in table 6.5.4.5-1.

8. Search the intermodulation product signals below and above the UL carrier frequency, then measure the rectangular filtered mean power of transmitting intermodulation for both signals, and calculate the ratios with the power measured in step 3.

9. Repeat the measurement using the second offset in table 6.5.4.5-1.

6.5.4.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 with the following exception:

Table 6.5.4.4.3-1: *PUSCH-Config*

Derivation Path: TS 38.508-1 [12], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

6.5.4.5 Test requirement

The ratio derived in step 6 and 8, shall not exceed the described value in table 6.5.4.5-1.

Table 6.5.4.5-1: Transmit Intermodulation

Wanted signal channel bandwidth	$BW_{Channel}$	
Interference signal frequency offset from channel center	$BW_{Channel}$	$2*BW_{Channel}$
Interference CW signal level	-40 dBc	
Intermodulation product	< -29 dBc	< -35 dBc
Measurement bandwidth	The maximum transmission bandwidth configuration among the different SCS's for the channel BW as defined in Table 6.5.2.4.5-1	
Measurement offset from channel center	$BW_{Channel}$ and $2*BW_{Channel}$	$2*BW_{Channel}$ and $4*BW_{Channel}$
NOTE: The test requirements do not apply when the interfering signal overlaps with the channel bandwidth of the downlink signal.		

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 clauses below.

With the exception of clause 7.3, the requirements shall be verified with the network signalling value NS_01 configured in Table 6.2.3.3.1-1.

All requirements in this clause are applicable to devices supporting GSO and/or NGSO satellites.

All the parameters in clause 7 are defined using the UL reference measurement channels specified in Annex A.2.2, the DL reference measurement channels specified in Annex A.3.2 and using the set-up specified in Annex C.3.1.

7.2 Diversity characteristics

The UE is required to be equipped with a minimum of two RX antenna ports in all operating bands.

The UE shall be verified with two RX antenna ports in all supported frequency bands.

The above rules apply for all clauses with the exception of clause 7.9.

7.3 Reference sensitivity

7.3.1 General

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

In later clauses of Clause 7 where the value of REFSENS is used as a reference to set the corresponding requirement. In all bands, the UE shall be verified against those requirements by applying the REFSENS value in Table 7.3.2.3-1.

7.3.2 Reference sensitivity power level

7.3.2.1 Test purpose

The test purpose is to verify the ability of the UE to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

7.3.2.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

7.3.2.3 Minimum conformance requirements

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annex A3.2, with parameters specified in Table 7.3.2.3-1.

Table 7.3.2.3-1: Two antenna port reference sensitivity QPSK PREFSENS for FDD bands

Operating band / SCS / Channel bandwidth					
Operating Band	**SCS (kHz)**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**
n256	15	-99.5	-96.3	-94.5	-93.8
	30		-96.6	-94.6	-94.0
	60		-97.0	-94.9	-94.2
n255	15	-100.0	-96.8	-95.0	-93.8
	30		-97.1	-95.1	-94.0
	60		-97.5	-95.4	-94.2
NOTE : The transmitter shall be set to P_{UMAX} as defined in clause 6.2.4.					

The reference receiver sensitivity (REFSENS) requirement specified in Table 7.3.2.3-1 shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.3-2.

Table 7.3.2.3-2: Uplink configuration for reference sensitivity

Operating band / SCS (kHz) / Channel bandwidth (MHz) / Duplex mode						
Operating Band	**SCS**	**5**	**10**	**15**	**20**	**Duplex Mode**
n256	15	25	50	75	100	FDD
	30		24	36	50	
	60		10	18	24	
n255	15	25	50	75	[75]	FDD
	30		24	36	[36]	
	60		10	18	[18]	
NOTE: 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 in Table 5.3.2-1.						

The minimum requirements specified in Table 7.3.2.3-1 shall be verified with the network signalling value NS_01 configured in Table 6.2.3.1-1.

The normative reference for this requirement is TS 38.101-5 [11] clause 7.3.2.

7.3.2.4 Test description

7.3.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 7.3.2.4.1-1, Table 7.3.2.4.1-2, and Table 7.3.2.4.1-3 The details of the uplink reference measurement channels (RMCs) are specified in Annex A.2.2 of TS 38.521-1 [2]. Configurations of PDSCH and PDCCH before measurement are specified in TS 38.521-1 [2] Annex C.2.

Table 7.3.2.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [12] subclause 4.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH	
Test Frequencies as specified in TS 38.508-1 [12] subclause4.3.1			Low range, Mid range, High range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1			Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1			Lowest	
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (NOTE 1)	DFT-s-OFDM QPSK	REFSENS (NOTE 2)
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to Table 7.3.2.4.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band.				

Table 7.3.2.4.1-2: Downlink Configuration of each RB allocation

Channel Bandwidth	**SCS(kHz)**	L_{CRBmax}	**Outer RB allocation / Normal RB allocation**
5MHz	15	25	25@0
	30	11	11@0
	60	N/A	N/A
10MHz	15	52	52@0
	30	24	24@0
	60	11	11@0
15MHz	15	79	79@0
	30	38	38@0
	60	18	18@0
20MHz	15	106	106@0
	30	51	51@0
	60	24	24@0
NOTE: Test Channel Bandwidths are checked separately for each NR band, the applicable channel bandwidths are specified in Table 5.3.5-1.			

Table 7.3.2.4.1-3: Uplink configuration for reference sensitivity, L_{CRB} @ RB_{start} format

Operating Band	**SCS kHz**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**
n256	15	25@0	50@0	75@0	100@0
	30		24@0	36@0	50@0
	60		10@0	18@0	24@0
n255	15	25@0	50@0	75@0	[75@0]
	30		24@0	36@0	[36@0]
	60		10@0	18@0	[18@0]

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.

3. Downlink signals are initially set up according to clauses C.0, C.1 and C.2, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, and G.3.1.

4. The UL and Reference Measurement Channel is set according to Table 7.3.2.4.1-1, Table 7.3.2.4.1-2, and Table 7.3.2.4.1-3.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 7.3.2.4.3.

7.3.2.4.2 Test procedure.

1. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through any preconfigured means.

2. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508-1 [12] Table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and Table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1.

3. Deactivate UE prediction of satellite trajectory by any preconfigured means.

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.3.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Tables 7.3.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6. Set the Downlink signal level to the appropriate REFSENS value defined in Table 7.3.2.5-1 if 2Rx antennas connected. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE to ensure the UE transmits PUMAX level for at least the duration of the Throughput measurement.

7. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.

7.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [12] clause 4.6 ensuring Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED for NR band.

Message contents are according to TS 38.508-1[12] subclause 4.6 with the following exceptions for each network signalling value.

SIB19 message contents according to TS 38.508-1 [12] clause 5.6.2.1

7.3.2.4.3.1 Message contents exceptions (network signalled value "NS_01")

Message contents according to TS 38.508-1 [12] subclause 4.6 can be used without exceptions.

7.3.2.5 Test requirement

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 with reference receive power level specified in Tables 7.3.2.5-1 and parameters specified Tables 7.3.2.4.1-1, Tables 7.3.2.4.1-2 and Tables 7.3.2.4.1-3.

Table 7.3.2.5-1: Two antenna port Reference sensitivity QPSK $P_{REFSENS}$ for FDD bands for PC3

Operating band / SCS / Channel bandwidth / Duplex-mode						
Operating Band	**SCS kHz**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**Duplex Mode**
n256	15	-99.5 +TT	-96.3 +TT	-94.5 +TT	-93.8 +TT	FDD
	30		-96.6 +TT	-94.6 +TT	-94.0 +TT	
	60		-97.0 +TT	-94.9 +TT	-94.2 +TT	
n255	15	-100.0 +TT	-96.8 +TT	-95.0 +TT	-93.8 +TT	FDD
	30		-97.1 +TT	-95.1 +TT	-94.0 +TT	
	60		-97.5 +TT	-95.4 +TT	-94.2 +TT	
	30		-96.6[3] +TT	-94.6[3] +TT	-93.5[3] +TT	
	60		-97.0[3] +TT	-94.9[3] +TT	-93.7[3] +TT	

NOTE 1: Void.
NOTE 2: The transmitter shall be set to PUMAX as defined in subclause 6.2.4
NOTE 3: 3 indicates that the requirement is modified by -0.5 dB when the assigned NR channel bandwidth is confined within 1475.9-1510.9 MHz.
NOTE 4: Void
NOTE 5: Void
NOTE 6: TT for each frequency and channel bandwidth is specified in Table 7.3.2.5-2.

Table 7.3.2.5-2: Test Tolerance (TT) for RX sensitivity level

f ≤ 3.0GHz
0.7 dB

7.4 Maximum input level

7.4.1 Test purpose

Maximum input level tests the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of high signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the coverage area near to a g-NodeB.

7.4.2 Test applicability

This test case applies to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

7.4.3 Minimum conformance requirements

Maximum input level 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. The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in 3GPP TS 38.101-1 [5] Annexes A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD as described in 3GPP TS 38.101-1 [5] Annex A.5.1.1) with parameters specified in Table 7.4.3-1.

Table 7.4.3-1: Maximum input level

Rx Parameter	Units	Channel bandwidth (MHz)
		5, 10, 15, 20
Power in Transmission Bandwidth Configuration[3]	dBm	-40[2]
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum uplink configuration specified in Table 7.3.2.3-2 with $P_{CMAX\_L,f,c}$ as defined in clause 6.2.4.		
NOTE 2: Reference measurement channel is specified in 3GPP TS 38.101-1 [5] Annex A.3.2.3 for 64 QAM.		
NOTE 3: Power in transmission bandwidth configuration value is rounded to the nearest 0.5dB value.		

The normative reference for this requirement is TS 38.101-5 [11] clause 7.4.

7.4.4 Test description

7.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.4.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.4.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [12] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters for Channel Bandwidths			
Downlink Configuration		**Uplink Configuration**	
Modulation	**RB allocation**	**Modulation**	**RB allocation**
CP-OFDM 64 QAM	NOTE 1	DFT-s-OFDM QPSK	NOTE 2
NOTE 1: The specific configuration of downlink RB allocation is defined in Table 7.3.2.4.1-2. NOTE 2: The specific configuration of uplink RB allocation is defined in Table 7.3.2.4.1-3.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.1.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.4.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through AT commands or any other preconfigured means.

7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508-1 [12] table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508[12] clause 5.6.3.1..

8. Deactivate UE prediction of satellite trajectory by any preconfigured means.9. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 7.4.4.3.

7.4.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.4.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Tables 7.4.4.1-1. Since the UE has no payload data and no loopback data to send, the UE sends uplink MAC padding bits on the UL RMC.

3. Set the Downlink signal level to the value as defined in Table 7.4.5-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.4.5-1 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [5], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

- For UEs supporting Tx diversity, the transmit power is measured as the sum of the output power from both UE antenna connectors.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.4.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.4.5 Test requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 with parameters specified in Tables 7.4.5-1.

Table 7.4.5-1: Maximum input level

Rx Parameter	Units	Channel bandwidth (MHz)
		5, 10, 15, 20
Power in Transmission Bandwidth Configuration[3]	dBm	-40[2] -TT
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum uplink configuration specified in Table 7.3.2.3-2 with $P_{CMAX\_L,f,c}$ as defined in clause 6.2.4. NOTE 2: Reference measurement channel is specified in 3GPP TS 38.101-1 [5] Annex A.3.2.3 for 64 QAM. NOTE 3: Power in transmission bandwidth configuration value is rounded to the nearest 0.5dB value.		

Table 7.4.5-2: Test Tolerance (Maximum input level)

f ≤ 3.0GHz
0.7 dB

7.5 Adjacent channel selectivity

7.5.1 Test purpose

Adjacent channel selectivity (ACS) is a measure of a receiver's ability to receive an NR 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).

7.5.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support satellite access operation.

7.5.3 Minimum conformance requirements

In Release 17, only frequency bands below 2.7GHz are considered. The NR satellite UE shall fulfil the minimum requirements specified in Table 7.5.3-1 for NR satellite bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2,700 MHz. These requirements apply for all values of an adjacent channel interferer in case 1 and for any SCS specified for the channel bandwidth of the wanted signal. The lower and upper range of test parameters are chosen as in Table 7.5.3-2 and Table 7.5.3-3 for verification of the requirements specified in Table 7.5.3-1. For these test parameters, the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in 3GPP TS 38.101-1 [5] Annexes A.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in 3GPP TS 38.101-1 [5] Annex A.5.1.1).

Table 7.5.3-1: ACS for NR satellite bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz

RX parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
ACS	dB	33	30	27

Table 7.5.3-2: Test parameters for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz, case 1

RX parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB		
$P_{interferer}$[4]	dBm	REFSENS + 45.5 dB	REFSENS + 42.5 dB	REFSENS + 39.5
$BW_{interferer}$	MHz	5		
$F_{interferer}$ (offset)[2]	MHz	$BW_{Channel}$ /2 + 2.5 / -($BW_{Channel}$ /2 + 2.5)		
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in clause 7.3.2 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $(\lceil \lvert F_{interferer} \rvert / SCS \rceil + 0.5) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 3: The interferer consists of the NR interferer RMC specified in 3GPP TS 38.101-1 [5] Annexes A.3.2.2 with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in 3GPP TS 38.101-1 [5] Annex A.5.1.1. NOTE 4: $P_{interferer}$ shall be rounded to the next higher 0.5dB value.				

Table 7.5.3-3: Test parameters for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz, case 2

RX parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
Power in transmission bandwidth configuration	dBm	-71.5	-68.5	-65.5
$P_{interferer}$	dBm	-40		
$BW_{interferer}$	MHz	5		
$F_{interferer}$ (offset)	MHz	$BW_{Channel}$ /2 + 2.5 / -($BW_{Channel}$ /2 + 2.5)		
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in clause 7.3.2 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $(\lceil \lvert F_{interferer} \rvert / SCS \rceil + 0.5) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 3: The interferer consists of the NR interferer RMC specified in 3GPP TS 38.101-1 [5] Annexes A.3.2.2 with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in 3GPP TS 38.101-1 [5] Annex A.5.1.1. NOTE 4: $P_{interferer}$ shall be rounded to the next higher 0.5dB value.				

The normative reference for this requirement is TS 38.101-5 [11] clause 7.5.

7.5.4 Test description

7.5.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 7.5.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.5.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [12] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1	Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1	Lowest, Mid, Highest			
Test SCS as specified in Table 5.3.5-1	Lowest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Modulation**	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, in Figure A.3.1.4.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.1, C.2, C.3.1, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2 and G.3.1.
4. The DL and UL Reference Measurement channels are set according to Table 7.5.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through any preconfigured means.
7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508-1 [12] Table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and Table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1.
8. Deactivate UE prediction of satellite trajectory by any preconfigured means.
9. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 7.5.4.3.

7.5.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.5.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.5.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3. Set the Downlink signal level to the value as defined in Table 7.5.5-2 as appropriate (Case 1). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5.5-2 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW.

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [5], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.2-1.

   - For UEs supporting Tx diversity, the transmit power is measured as the sum of the output power from both UE antenna connectors.

4. Set the Interferer signal level to the value as defined in Table 7.5.5-2 as appropriate (Case 1) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.

6. Repeat steps from 3 to 5, using an interfering signal above the wanted signal in Case 1 at step 4.

7. Set the Downlink signal level to the value as defined in Table 7.5.5-3 as appropriate (Case 2). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5.5-3 for at least the duration of the Throughput measurement, where MU and Uplink power control window size are defined above.

8. Set the Interferer signal level to the value as defined in Table 7.5.5-3 as appropriate (Case 2) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

9. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.

10. Repeat steps from 7 to 9, using an interfering signal above the wanted signal in Case 2 at step 8.

11. Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.5.4.3 Message contents

Message contents are according to TS 38.508-1 [12] clause 4.6 ensuring Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

Message contents are according to TS 38.508-1[12] subclause 4.6 with the following exceptions for each network signalling value.

SIB19 message contents according to TS 38.508-1 [12] clause 5.6.2.1.

7.5.5 Test requirement

For NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in

3GPP TS 38.101-1 [5] Annexes A.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in 3GPP TS 38.101-1 [5] Annex A.5.1.1 with parameters specified in Tables 7.5.5-2 and 7.5.5-3.

Table 7.5.5-1: ACS for NR satellite bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz

RX parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
ACS	dB	33	30	27

Table 7.5.5-2: Test parameters for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz, case 1

RX parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB		
$P_{interferer}$[4]	dBm	REFSENS + 45.5 dB	REFSENS + 42.5 dB	REFSENS + 39.5
$BW_{interferer}$	MHz	5		
$F_{interferer}$ (offset)[2]	MHz	$BW_{Channel}$ /2 + 2.5 / -($BW_{Channel}$ /2 + 2.5)		
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in clause 7.3.2 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $(\lceil \lvert F_{interferer} \rvert / SCS \rceil + 0.5)SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 3: The interferer consists of the NR interferer RMC specified in 3GPP TS 38.101-1 [5] clause A.3.2.2 with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in 3GPP TS 38.101-1 [5] Annex A.5.1.1. NOTE 4: $P_{interferer}$ shall be rounded to the next higher 0.5dB value.				

Table 7.5.5-3: Test parameters for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz, case 2

RX parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
Power in transmission bandwidth configuration	dBm	-71.5	-68.5	-65.5
$P_{interferer}$	dBm	-40		
$BW_{interferer}$	MHz	5		
$F_{interferer}$ (offset)	MHz	$BW_{Channel}$ /2 + 2.5 / -($BW_{Channel}$ /2 + 2.5)		
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in clause 7.3.2 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $(\lceil \lvert F_{interferer} \rvert / SCS \rceil + 0.5)SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 3: The interferer consists of the NR interferer RMC specified in 3GPP TS 38.101-1 [5] clause A.3.2.2 with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in 3GPP TS 38.101-1 [5] clause A.5.1.1. NOTE 4: $P_{interferer}$ shall be rounded to the next higher 0.5 dB value.				

7.6 Blocking characteristics

7.6.1 General

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 occurs.

7.6.2 In-band blocking

[to be updated]

7.6.3 Out of Band Blocking

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Addition to applicability spec is pending
- Initial condition and call setup procedure to support NR satellite access is to be updated
- Message exceptions specific to satellite access is to be updated
- Test Points analysis is to be updated
- Test configuration is to be updated
- Annex F MU/TT is to be updated

7.6.3.1 Test purpose

Out-of-band band blocking is defined for an unwanted CW interfering signal falling outside a frequency range 15 MHz below or above the UE receive band, with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz.

7.6.3.2 Test applicability

The requirements of this test apply to all types of NR Power Class 3 UE release 17 and forward that support satellite access operation.

7.6.3.3 Minimum conformance requirements

For NR satellite bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz out-of-band band blocking is defined for an unwanted CW interfering signal falling outside a frequency range 15 MHz below or above the UE receive band.

The throughput of the wanted signal shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in 3GPP TS 38.101-1 [5] clauses A.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in clauses A.5.1.1) with parameters specified in Table 7.6.3-1 and Table 7.6.3-2. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 7.6.3-1: Out-of-band blocking parameters for NR satellite bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz

RX parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
Power in transmission bandwidth configuration[2]	dBm	REFSENS + 6 dB	REFSENS + 7 dB	REFSENS + 9 dB
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in clause 7.3.2 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.				
NOTE 2: Power in transmission bandwidth configuration shall be rounded to the next higher 0.5dB value.				

Table 7.6.3-2: Out-of-band blocking for NR satellite bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz

Operating Band	Parameter	Unit	Range 1	Range 2	Range 3
	$P_{interferer}$	dBm	-44	-30	-15
n255	$F_{interferer}$ (CW)	MHz	$-60 < f - F_{DL\_low} < -15$ or $15 < f - F_{DL\_high} < 60$	$-85 < f - F_{DL\_low} \le -60$ or $60 \le f - F_{DL\_high} < 85$	$1 \le f \le F_{DL\_low} - 85$ or $F_{DL\_high} + 85 \le f \le 12750$
n256[1]	$F_{interferer}$ (CW)	MHz	$-100 < f - F_{DL\_low} < -15$ or $15 < f - F_{DL\_high} < 60$	$-145 < f - F_{DL\_low} \le -100$ or $60 \le f - F_{DL\_high} < 85$	$1 \le f \le F_{DL\_low} - 145$ or $F_{DL\_high} + 85 \le f \le 12750$
NOTE 1: Band n256 lower frequency ranges are modified to enable specific implementations NOTE 2: void NOTE 3: void NOTE 4: void					

For interferer frequencies across ranges 1, 2 and 3 in Table 7.6.3-1, a maximum of

$$\lfloor \max\{24, 6 \cdot \lceil n \cdot N_{RB} / 6 \rceil\} / \min\{\lfloor n \cdot N_{RB} / 10 \rfloor, 5\} \rfloor$$

exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a step size of $min(\lfloor BW_{channel}/2 \rfloor, 5)$ MHz with N_{RB} the number of resource blocks in the downlink transmission bandwidth configuration, $BW_{Channel}$ the bandwidth of the frequency channel in MHz and n = 1, 2, 3 for SCS = 15, 30, 60 kHz, respectively. For these exceptions, the requirements in clause 7.7 apply.

The normative reference for this requirement is TS 38.101-5 [11] clause 7.6.3.

7.6.3.4 Test description

7.6.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of test channel bandwidth and sub-carrier spacing, and are shown in Table 7.6.3.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in TS 38.521-1 [2] clause A.2. Configurations of PDSCH and PDCCH before measurement are specified in TS 38.521-1 [2] Annex C.2.

Table 7.6.3.4.1-1: Test Configuration Table for power class 3

[to be updated]

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, Figure A.3.1.2.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to TS 38.521-1 [2] Annex C.0, C.1, C.2, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, G.3.0.
4. The UL Reference Measurement Channel is set according to Table 6.2.2.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through AT commands or any other preconfigured means.

7. Test equipment shall emulate Zero Doppler conditions in service link and Common TA delay according to SIB19 configuration in TS 38.508-1 [12].

8. Ensure the UE is in State [to be updated] with generic procedure parameters [to be updated], Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 7.6.3.4.3.

7.6.3.4.2 Test procedure

[to be updated]

7.6.3.4.3 Message contents

Message contents are according to TS 38.508-1 [12] subclause 4.6 and 5.4 with the following exceptions:

[to be updated]

7.6.3.5 Test requirement

[to be updated]

7.6.4 Narrow band blocking

[to be updated]

7.7 Spurious response

7.7.1 Test Purpose

Spurious response is a measure of the ability of the receiver 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 for which a response is obtained, i.e. for which the out-of-band blocking limit as specified in subclause 7.6.3 is not met.

The lack of the spurious response ability decreases the coverage area when other unwanted interfering signal exists at any other frequency.

7.7.2 Test Applicability

This test case applies to all types of NR UE release 17 and forward that support satellite access operation.

7.7.3 Minimum Conformance Requirements

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in 3GPP TS 38.101-1 [5] Annexes A.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in Annex A.5.1.1) with parameters for the wanted signal as specified in Table 7.7.3-1 for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz and for the interferer as specified in Table 7.7.3-2. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 7.7.3-1: Spurious response parameters for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz

RX parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
Power in transmission bandwidth configuration[2]	dBm	REFSENS + 6 dB	REFSENS + 7 dB	REFSENS + 9 dB
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.				
NOTE 2: Power in transmission bandwidth configuration value is rounded to the next higher 0.5dB value.				

Table 7.7.3-2: Spurious response

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies

The normative reference for this requirement is TS 38.101-5 [11] clause 7.7.

7.7.4 Test Description

7.7.4.1 Initial Conditions

The initial conditions shall be the same as in clause 7.6.3.4.1 in order to test spurious responses obtained in clause 7.6.3 under the same conditions.

7.7.4.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6.3.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6.3.4.1-1. Since the UE has no payload and no loopback data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3. Set the parameters of the CW signal generator for an interfering signal according to Table 7.7.5-2. The spurious frequencies are taken from records in the final step of test procedures in clause 7.6.3.4.2.

4. Set the downlink signal level according to the Table 7.7.5-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.7.5-1 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [5], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

   - For UEs supporting Tx diversity, the transmit power is measured as the sum of the output power from both UE antenna connectors.

5. For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.7.4.3 Message Contents

Message contents are according to TS 38.508-1 [12] clause 4.6 ensuring Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED for NR band.

Message contents are according to TS 38.508-1[12] subclause 4.6 with the following exceptions for each network signalling value.

SIB19 message contents according to TS 38.508-1 [12] clause 5.6.2.1. Message contents are according to TS 38.508-1 [12] clause 4.6 ensuring Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED for NR band.

Message contents are according to TS 38.508-1[12] subclause 4.6 with the following exceptions for each network signalling value.

SIB19 message contents according to TS 38.508-1 [12] clause 5.6.2.1.

7.7.5 Test Requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 with parameters for the wanted signal as specified in Table 7.7.5-1 for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz and for the interferer as specified in Table 7.7.5-2.

Table 7.7.5-1: Spurious response parameters for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz

RX parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
Power in transmission bandwidth configuration[2]	dBm	REFSENS + 6 dB	REFSENS + 7 dB	REFSENS + 9 dB
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.				
NOTE 2: Power in transmission bandwidth configuration value is rounded to the next higher 0.5dB value.				

Table 7.7.5-2: Spurious response

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies

7.8 Intermodulation characteristics

7.8.1 General

Intermodulation response rejection is a measure of the capability of the receiver to receive 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.

7.8.2 Wide band Intermodulation

7.8.2.1 Test purpose

Intermodulation response tests the UE's ability to receive data with a given average throughput for a specified reference measurement channel, in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal, under conditions of ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the coverage area when two or more interfering signals exist which have a specific frequency relationship to the wanted signal.

7.8.2.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support satellite access operation.

7.8.2.3 Minimum conformance requirements

The wide band intermodulation requirement is defined using a CW carrier and modulated NR signal as interferer 1 and interferer 2 respectively.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in 3GPP TS 38.101-1 [5] Annexes A.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in Annex A.5.1.1) with parameters specified in Table 7.8.2.3-1 for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 7.8.2.3-1: Wide band intermodulation parameters for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz

Rx parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
P_W in Transmission Bandwidth Configuration, per CC[5]	dBm	REFSENS + 6 dB	REFSENS + 7 dB	REFSENS + (9 + $10\log_{10}(BW_{Channel}/20)$) dB
$P_{Interferer\ 1}$ (CW)	dBm	-46		
$P_{Interferer\ 2}$ (Modulated)	dBm	-46		
$BW_{Interferer\ 2}$	MHz	5		
$F_{Interferer\ 1}$ (Offset)	MHz	$-BW_{channel}/2 - 7.5$ / $+BW_{channel}/2 + 7.5$		
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$		

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2: Reference measurement channel is specified in 3GPP TS 38.101-1 [5] Annexes A.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in Annex A.5.1.1).
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in 3GPP TS 38.101-1 [5] Annexe A.3.2.2 with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in Annex A.5.1.1 and 15 kHz SCS.
NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.
NOTE 5: $10\log_{10}(x)$ is rounded to the next higher 0.5dB value.

The normative reference for this requirement is TS 38.101-5 [11] clause 7.8.

7.8.2.4 Test description

7.8.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 7.8.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.8.2.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [12] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1	Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1	Lowest, Mid, Highest			
Test SCS as specified in Table 5.3.5-1	Highest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Modulation**	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, in Figure A.3.1.4.3 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to clauses C.0, C.1, C.2, C.3.1, and uplink signals according to TS 38.521-1 [2] clauses G.0, G.1, G.2, G.3.1.
4. The DL and UL Reference Measurement channels are set according to Table 7.8.2.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through any preconfigured means.
7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] Table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and Table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1.
8. Deactivate UE prediction of satellite trajectory by any preconfigured means.
9. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 7.8.2.4.3.

7.8.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.8.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.
2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.8.2.4.1-1. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3. Set the Downlink signal level to the value as defined in Table 7.8.2.5-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.8.2.5-1 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [5], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

   - For UEs supporting Tx diversity, the transmit power is measured as the sum of the output power from both UE antenna connectors.

4. Set the Interfering signal levels to the values as defined in Table 7.8.2.5-1 and frequency below the wanted signal.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.

6. Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 4.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.8.2.4.3 Message contents

Message contents are according to TS 38.508-1 [12] clause 4.6 ensuring Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED for NR band.

Message contents are according to TS 38.508-1[12] subclause 4.6 with the following exceptions for each network signalling value.

SIB19 message contents according to TS 38.508-1 [12] clause 5.6.2.1.

7.8.2.5 Test requirement

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 with parameters specified in Table 7.8.2.5-1 for the specified wanted signal mean power in the presence of two interfering signals.

Table 7.8.2.5-1: Wide band intermodulation parameters for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz

Rx parameter	Units	Channel bandwidth (MHz)		
		5, 10	15	20
P_W in Transmission Bandwidth Configuration, per CC[5]	dBm	REFSENS + 6 dB	REFSENS + 7 dB	REFSENS + (9 + $10\log_{10}(BW_{Channel}/20)$) dB
$P_{Interferer\ 1}$ (CW)	dBm	-46		
$P_{Interferer\ 2}$ (Modulated)	dBm	-46		
$BW_{Interferer\ 2}$	MHz	5		
$F_{Interferer\ 1}$ (Offset)	MHz	$-BW_{channel}/2 - 7.5$ / $+BW_{channel}/2 + 7.5$		
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$		

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2: Reference measurement channel is specified in 3GPP TS 38.101-1 [5] Annexes A.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in Annex A.5.1.1).
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in 3GPP TS 38.101-1 [5] Annexes A.3.2.2 with one sided dynamic OCNG Pattern OP.1 FDD for the DL-signal as described in Annex A.5.1.1 and 15 kHz SCS.
NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.
NOTE 5: $10\log_{10}(x)$ is rounded to the next higher 0.5dB value.

7.9 Spurious emissions

7.9.1 Test purpose

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

Test verifies the UE's spurious emissions meet the requirements described in clause 7.9.3.

Excess spurious emissions increase the interference to other systems.

7.9.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support satellite access operation.

7.9.3 Minimum conformance requirements

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.3-1

Table 7.9.3-1: General receiver spurious emission requirements

Frequency range	Measurement bandwidth	Maximum level	NOTE
30 MHz ≤ f < 1 GHz	100 kHz	-57 dBm	
1 GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	
NOTE: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH as defined in Annex C.3.1.			

The normative reference for this requirement is TS 38.101-5 [11] clause 7.9.

7.9.4 Test description

7.9.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in Table 7.9.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.9.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [12] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [12] subclause 4.3.1	Low range, Mid range, High range			
Test Channel Bandwidths as specified in TS 38.508-1 [12] subclause 4.3.1	Highest			
Test SCS as specified in Table 5.3.5-1	Highest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Modulation**	**RB allocation**	**Modulation**	**RB allocation**
1	N/A	0	N/A	0

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, in Figure A.3.1.5.1 for TE diagram and clause A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [12] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.1, C.2, C.3.1, and uplink signals according to TS 38.521-1 [2] Annex G.0, G.1, G.2, G.3.1.
4. The DL and UL Reference Measurement channels are set according to Table 7.9.4.1-1.
5. Propagation conditions are set according to [Annex B.0].
6. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through any preconfigured means.
7. Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508 [12] Table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and Table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information during the duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1.
8. Deactivate UE prediction of satellite trajectory by any preconfigured means.
9. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 7.9.4.3.

7.9.4.2 Test procedure

1. Sweep the spectrum analyser (or equivalent equipment) over a frequency range and measure the average power of spurious emission.

2. Repeat step 1 for all NR Rx antennas of the UE.

7.9.4.3 Message contents

Message contents are according to TS 38.508-1 [12] clause 4.6 ensuring Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED for NR band.

Message contents are according to TS 38.508-1[12] subclause 4.6 with the following exceptions for each network signalling value.

SIB19 message contents according to TS 38.508-1 [12] clause 5.6.2.1.

7.9.5 Test requirement

The measured spurious emissions derived in step 1), shall not exceed the maximum level specified in Table 7.9.5-1.

Table 7.9.5-1: General receiver spurious emission requirements

Frequency range	Measurement bandwidth	Maximum level	NOTE
30 MHz ≤ f < 1 GHz	100 kHz	-57 dBm	
1 GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	
NOTE: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH as defined in Annex C.3.1.			

8 Conducted performance requirements

8.0 General

[to be updated]

8.1.1 Relationship between minimum requirements and test requirements

TS 38.101-5 is a Single-RAT and interwork specification for NR UE, covering minimum performance requirements of both conducted and radiated requirements. Conformance to 38.101-5 is demonstrated by fulfilling the test requirements specified in the present document.

The Minimum Requirements given in TS 38.101-5 make no allowances for measurement uncertainty (MU). The present document defines test tolerances (TT). These test tolerances are individually calculated for each test. The test tolerances are used to relax the minimum requirements in 38.101-4 to create test requirements. For some requirements, including regulatory requirements, the test tolerance is set to zero.

The measurement results returned by the test system are compared – without any modification – against the test requirements as defined by various level of "Shared Risk" principle as described below.

a) Core specification value is not relaxed by any relaxation value (TT=0). For each single measurement, the probability of a borderline good UE being judged as FAIL equals the probability of a borderline bad UE being judged as PASS.

   - Test tolerances equal to 0 (TT=0) are considered in this specification.

b) Core specification value is relaxed by a relaxation value (TT>0). For each single measurement, the probability of a borderline bad UE being judged as PASS is greater than the probability of a borderline good UE being judged as FAIL.

- Test tolerances lower than measurement uncertainty and greater than 0 (0 < TT < MU) are considered in this specification.

- Test tolerances high up to measurement uncertainty (TT = MU) are considered in this specification which is also known as "Never fail a good DUT" principle.

c) Core specification value is tightened by a stringent value (TT<0). For each single measurement, the probability of a borderline good UE being judged as FAIL is greater than the probability of a borderline bad UE being judged as PASS.

Test tolerances lower than 0 (TT<0) are not considered in this specification.

The "Never fail a good DUT" and the "Shared Risk" principles are defined in Recommendation ITU-R M.1545.

8.1.2 Applicability of minimum requirements

The conducted minimum requirements specified in the present document shall be met in all applicable scenarios for FR1. The interwork minimum requirement specified in the present document shall be met in all applicable scenarios for NR interworking operation.

All minimum performance requirements defined in Clause 8 are applicable to NR/5GC, EN-DC and NE-DC unless otherwise explicitly stated.

Unless otherwise stated, all minimum performance requirements defined in Clause 8 are applicable to UE power class 3 only.

8.1.3 Conducted requirements

8.1.3.1 Introduction

The requirements are defined for the following modes:

- Mode 1: Conditions with external noise source

  - Wanted signal with power level Es is transmitted.

  - External white noise source with power spectral density Noc is used.

  - *Es* and *Noc* levels are selected to achieve target SNR as described in Clause 8.1.3.3.

8.1.3.2 Reference point

The reference point for SNR, Es and Noc of DL signal is the UE antenna connector or connectors.

8.1.3.3 SNR definition

For Mode 1 conditions conducted UE demodulation and CSI requirements the SNR is defined as:

$$SNR = \frac{\sum_{j=1}^{N_{RX}} E_s^{(j)}}{\sum_{j=1}^{N_{RX}} N_{oc}^{(j)}}$$

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, and does not account for any gain which can be associated to the precoding operation.

- Unless otherwise stated, the SNR refers to the SSS wanted signal.

- The downlink SSS transmit power is defined as the linear average over the power contributions in [W] of all resource elements that carry the SSS within the operating system bandwidth.

- The power ratio of other wanted signals to the SSS is defined in clause C.3.1.

8.1.3.4 Noc

8.1.3.4.1 Introduction

This clause describes the Noc power level for Mode 1 conditions conducted testing of demodulation and CSI requirements.

8.1.3.4.2 Noc for NR operating bands in FR1

The Noc power spectrum density shall be larger or equal to the minimum Noc power level for each operating band supported by the UE as defined in clause 8.1.3.4.2.1.

Unless otherwise stated, a fixed Noc power level of -145 dBm/Hz shall be used for all operating bands.

8.1.3.4.2.1 Derivation of Noc values for NR operating bands in FR1

The minimum Noc power level for an operating band, subcarrier spacing and channel bandwidth is derived based on the following equation:

$Noc_{Band\_X,\ SCS\_Y,\ CBW\_Z} = REFSENS_{Band\_X,\ SCS\_Y,\ CBW\_Z} - 10*\log10(12*SCS\_Y*nPRB) + D - SNR_{REFSENS} + \Delta_{thermal}$

where

- $REFSENS_{Band\_X,\ SCS\_Y,\ CBW\_Z}$ is the REFSENS value in dBm for Band X, SCS Y and CBW Z specified in Table 7.3.2-1 of TS 38.101-5 [11]
- 12 is the number of subcarriers in a PRB
- SCS Y is the subcarrier spacing associated with the REFSENS value
- nPRB is the maximum number of PRB for SCS Y and CBW Z associated with the REFSENS value, and is specified in Table 5.3.2-1 of TS 38.101-5 [11]
- D is diversity gain equal to 3 dB
- $SNR_{REFSENS}$ = -1 dB is the SNR used for simulation of REFSENS
- $\Delta_{thermal}$ is the amount of dB that the wanted noise is set above UE thermal noise, giving a defined rise in total noise. $\Delta_{thermal}$ = 16 dB, giving a rise in total noise of 0.1dB, regarded as insignificant**.**

The calculated Noc value for the baseline of Band n256, 15 kHz SCS, 10 MHz CBW is -146.5 dBm/Hz. An allowance of 1.5 dB is made for future bands, giving an Noc power level of -145 dBm/Hz.

8.2 Demodulation performance requirements

8.2.1 General

8.2.1.1 Applicability of requirements

8.2.1.1.1 General

The minimum performance requirements are applicable to all FR1 operating bands defined in clause 5.2.

If same test is listed for different UE features/capabilities in Clause 8.2.1.1.2, then this test shall apply for UEs which support all corresponding UE features/capabilities.

8.2.1.1.2 Applicability of requirements for optional UE features

The performance requirements in Table 8.2.1.1.2-1 shall apply for UEs which support optional UE features only.

Table 8.2.1.1.2-1: Requirements applicability for optional UE features

UE feature/capability 13]	Test type		Test list	Applicability notes
NR NTN access (nonTerrestrialNetwork-r17)	FR1 FDD	PDSCH	Clause 8.2.1.2.2.1 (Test 1-1, Test 1-2, Test 1-3, Test 1-4)	
NR NTN scenario support (ntn-ScenarioSupport-r17)	FR1 FDD	PDSCH	Clause 8.2.1.2.2.1 (Test 1-1, Test 1-2, Test 1-3, Test 1-4)	The requirements apply only when *ntn-ScenarioSupport-r17* is "ngso" or is not included.
Increasing the number of HARQ processes (max-HARQ-ProcessNumber-r17)	FR1 FDD	PDSCH	Clause 8.2.1.2.2.1 (Test 1-3)	
Disabled HARQ feedback for downlink transmission (harq-FeedbackDisabled-r17)	FR1 FDD	PDSCH	Clause 8.2.1.2.2.1 (Test 1-4)	
NOTE: For UE supporting NR NTN access (nonTerrestrialNetwork-r17), the requirements in TS 38.101-4 [6] also applies to UE according to applicability rules in TS 38.101-4 [6] Clause 5.1, 6.1, 7.1 and 8.1				

8.2.1.2.0 PDSCH demodulation requirements

The parameters specified in Table 8.2.1.2.0-1 are valid for all PDSCH tests unless otherwise stated.

Table 8.2.1.2.0-1: Common test parameters

Parameter		Unit	Value
PDSCH transmission scheme			Transmission scheme 1
Carrier configuration	Offset between Point A and the lowest usable subcarrier on this carrier (Note 2)	RBs	0
	Subcarrier spacing	kHz	15
DL BWP configuration #1	Cyclic prefix		Normal
	RB offset	RBs	0
	Number of contiguous PRB	PRBs	Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [5] for tested channel bandwidth and subcarrier spacing
Common serving cell parameters	Physical Cell ID		0
	SSB position in burst		First SSB in Slot #0
	SSB periodicity	ms	20
PDCCH configuration	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH	Symbols	0, 1
	Number of PRBs in CORESET		Table 5.2-2 of 38.101-4 for tested channel bandwidth and subcarrier spacing
	Number of PDCCH candidates and aggregation levels		1/AL8
	CCE-to-REG mapping type		Non-interleaved
	DCI format		1_1
	TCI state		TCI state #1
	PDCCH & PDCCH DMRS Precoding configuration		Single Panel Type I, Random per slot with equal probability of each applicable i_1, i_2 combination, and with REG bundling granularity for number of Tx larger than 1
Cross carrier scheduling			Not configured
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k_0=0 for CSI-RS resource 1,2,3,4
	First OFDM symbol in the PRB used for CSI-RS		l_0 = 6 for CSI-RS resource 1 and 3 l_0 = 10 for CSI-RS resource 2 and 4
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
	Density (ρ)		3 for CSI-RS resource 1,2,3,4
	CSI-RS periodicity	Slots	15 kHz SCS: 20 for CSI-RS resource 1,2,3,4
	CSI-RS offset	Slots	15 kHz SCS: 10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4
	Frequency Occupation		Start PRB 0 Number of PRB = ceil(BWP size/4)*4
	QCL info		TCI state #0
NZP CSI-RS for CSI acquisition	Row index (Note 3)		3 for 2 CSI-RS ports and 5 for 4 CSI-RS ports
	First subcarrier index in the PRB used for CSI-RS		k_0 = 0
	First OFDM symbol in the PRB used for CSI-RS		l_0 = 12
	Number of CSI-RS ports (X)		Same as number of transmit antenna
	CDM Type		'No CDM' for 1 transmit antenna 'FD-CDM2' for 2 and 4 transmit antenna
	Density (ρ)		1
	CSI-RS periodicity	Slots	15 kHz SCS: 20
	CSI-RS offset	Slots	0
	Frequency Occupation		Start PRB 0 Number of PRB = ceil(BWP size/4)*4
	QCL info		TCI state #1
ZP CSI-RS for CSI acquisition	Row index (Note 3)		5
	First subcarrier index in the PRB used for CSI-RS		k_0 = 4

	First OFDM symbol in the PRB used for CSI-RS			l_0 = 12
	Number of CSI-RS ports (X)			4
	CDM Type			'FD-CDM2'
	Density (ρ)			1
	CSI-RS periodicity		Slots	15 kHz SCS: 20
	CSI-RS offset		Slots	0
	Frequency Occupation			Start PRB 0 Number of PRB = ceil(BWP size/4)*4
PDSCH DMRS configuration	Antenna ports indexes			{1000} for Rank 1 tests
	Position of the first DMRS for PDSCH mapping type A			2
	Number of PDSCH DMRS CDM group(s) without data			1 for Rank 1
TCI state #0	Type 1 QCL information	SSB index		SSB #0
		QCL Type		Type C
	Type 2 QCL information	SSB index		N/A
		QCL Type		N/A
TCI state #1	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking' configuration
		QCL Type		Type A
	Type 2 QCL information	CSI-RS resource		N/A
		QCL Type		N/A
PT-RS configuration				PT-RS is not configured
Maximum number of code block groups for ACK/NACK feedback				1
Maximum number of HARQ transmission				4
HARQ ACK/NACK bundling				Multiplexed
Redundancy version coding sequence				{0,2,3,1}
PDSCH & PDSCH DMRS Precoding configuration				Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i_1, i_2 combination, and with PRB bundling granularity
Symbols for all unused REs				OP.1 FDD as defined in Annex A.5.1.1 of 38.101-4
Physical signals, channels mapping and precoding				As specified in Annex B.4.1 of 38.101-4
NOTE 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission. NOTE 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [5] for tested channel bandwidth and subcarrier spacing. NOTE 3: Refer to Table 7.4.1.5.3-1 in [9]				

8.2.1.2.1 1RX requirements

[to be updated]

8.2.1.2.2 2RX requirements

8.2.1.2.2.1 FDD

8.2.1.2.2.1.1 Minimum requirements for PDSCH Mapping Type A

The performance requirements are specified in Table 8.2.1.2.2.1.1-3 with the addition of test parameters in Table 8.2.1.2.2.1.1-2 and the downlink physical channel setup according to Annex A.3.

The test purposes are specified in Table 8.2.1.2.2.1.1-1.

Table 8.2.1.2.2.1.1-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models and MCS	1-1, 1-2, 1-3, 1-4

Table 8.2.1.2.2.1.1-2: Test parameters

Parameter		Unit	Value
Duplex mode			FDD
Active DL BWP index			1
PDSCH configuration	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
PDSCH DMRS configuration	DMRS Type		Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
CSI-RS for tracking	CSI-RS periodicity	Slots	20 for CSI-RS resource 1,2,3,4.
	CSI-RS offset	Slots	10 for CSI-RS resource 1 and 2 11 for CSI-RS resource 3 and 4.
Number of HARQ Processes			16 for Test 1-1, Test 1-2 32 for Test 1-3 4 with feedback disabled, 12 with feedback enabled in 16 HARQ processes with re-Tx disable for all HARQ for Test 1-4 in which 4 disabled processes are randomly select at test configuration
The number of slots between PDSCH and corresponding HARQ-ACK information			10 for Test 1-1, Test 1-2, Test 1-3 N/A for Test 1-4
Maximum number of HARQ transmission			4 for Test 1-1, Test 1-2, Test 1-3 Disabled for all HARQ processes for Test 1-4

Table 8.2.1.2.2.1.1-3: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.1 FDD	10 / 15	QPSK, 0.30	NTN-TDLA100-200	1x2, ULA Low	70	0.3
1-2	R.PDSCH.1-2.1 FDD	10 / 15	16QAM, 0.48	NTN-TDLC5-200	1x2, ULA Low	70	7.6
1-3	R.PDSCH.1-1.1 FDD	10 / 15	QPSK, 0.30	NTN-TDLC5-200	1x2, ULA Low	70	-0.4
1-4	R.PDSCH.1-1.1 FDD	10 / 15	QPSK, 0.30	NTN-TDLA100-200	1x2, ULA Low	70	1.1

The normative reference for this requirement is TS 38.101-5 [11] clause 8.2.1.2.2.

8.2.1.2.2.1.1_1 2Rx FDD FR1 PDSCH Mapping Type A for Satellite Access

Editor's Note: This test cases is incomplete in following aspects:

- Annex G Minimum test time

8.2.1.2.2.1.1_1.1 Test Purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models and MCS for NTN capable UE receiving signal from earth based gNB via a satellite access node.

8.2.1.2.2.1.1_1.2 Test Applicability

This test applies to all types of NTN UE release 17 and forward supporting satellite access.

8.2.1.2.2.1.1_1.3 Test Description

8.2.1.2.2.1.1_1.3.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [2].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [12] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [12] clause 5.2.2.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [12] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.
2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.1.0-2 as appropriate.
3. Downlink signals for NR cell are initially set up according to clauses C.0, C.1, C.2 and uplink signals according to clauses G.0, G.1, G.2, G.3.1 of TS 38.521-1 [2].
4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR for NR/5GC with *Connected without Release On, Test Mode* On according to TS 38.508-1 [12] clause 4.5. Message contents are defined in clause 8.2.1.2.2.1.1_1.3.3.

8.2.1.2.2.1.1_1.3.2 Test procedure

1. UE location according to TS 38.508-1 [12] clause 5.6.1 is provided to the UE through any preconfigured means.

2 Test equipment shall emulate the signal with doppler and delay according to ephemeris defined in TS 38.508[12] table 5.6.2.1-1 for GSO if UE supports only GSO or both GSO and NGSO satellites and table 5.6.2.1-3 for NGSO (LEO-1200) if UE supports only NGSO satellites. Test system shall send same SIB19 information duringthe duration of the test as defined in TS 38.508-1 [12] clause 5.6.3.1.

3. Deactivate UE prediction of satellite trajectory by any preconfigured means.

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Tables Table 8.2.1.2.2.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 8.2.1.2.2.1.1-2 and Table 8.2.1.2.2.1.1-3 as appropriate.

6. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to [Annex G].

4. Repeat steps from 1 to 3 for each subtest in Table 8.2.1.2.2.1.1-3 as appropriate.

8.2.1.2.2.1.1_1.3.3 Message contents

Message contents are according to TS 38.508-1 [12] clauses 4.6.1 and 5.4.2.

SIB19 contents as TS 38.508-1 [12] clause 5.6.2.1.

Table 8.2.1.2.2.1.1_1.3.3-1: DMRS-DownlinkConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24			
Information Element	**Value/remark**	**Comment**	**Condition**
DMRS-DownlinkConfig ::= SEQUENCE {			
dmrs-AdditionalPosition	Pos1		
}			

Table 8.2.1.2.2.1.1_1.3.3-2: PDSCH-ServingCellConfig

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25			
Information Element	**Value/remark**	**Comment**	**Condition**
PDSCH-ServingCellConfig ::= SEQUENCE {			
nrofHARQ-ProcessesForPDSCH	n16	Test 1-1, Test 1-2	
	n32	Test 1-3	
		Test 1-4 4 with feedback disabled, 12 with feedback enabled in 16 HARQ processes with re-Tx disable for all HARQ for Test 1-4 in which 4 disabled processes are randomly select at test configuration	
}			

Table 8.2.1.2.2.1.1_1.3.3-3: CSI-ResourcePeriodicityAndOffset for CSI Tracking

Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9			
Information Element	**Value/remark**	**Comment**	**Condition**
CSI-ResourcePeriodicityAndOffset ::= CHOICE {			
slots20	10 (for CSI-RS resources 1 and 2) 11 (for CSI-RS resources 3 and 4)		
}			

8.2.1.2.2.1.1_1.3.4 Test requirement

Table 8.2.1.2.2.1.1-2 and Table 8.2.1.2.2.1.1-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1.1 for each throughput test shall meet or exceed the specified value in Table 8.2.1.2.2.1.1_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 8.2.1.2.2.1.1_1.3.4-1: Minimum performance for Rank 1

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	Correlation matrix and antenna configuration	Reference value	
						Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1-1.1 FDD	10 / 15	QPSK, 0.30	NTN-TDLA100-200	1x2, ULA Low	70	1.2
1-2	R.PDSCH.1-2.1 FDD	10 / 15	16QAM, 0.48	NTN-TDLC5-200	1x2, ULA Low	70	8.5
1-3	R.PDSCH.1-1.1 FDD	10 / 15	QPSK, 0.30	NTN-TDLC5-200	1x2, ULA Low	70	0.5
1-4	R.PDSCH.1-1.1 FDD	10 / 15	QPSK, 0.30	NTN-TDLA100-200	1x2, ULA Low	70*	2

Annex A: (normative): Measurement channels

A.1 General

A.1.1 Throughput definition

The throughput values defined in the measurement channels specified in Annex A, are calculated and are valid per codeword. For multi-codeword transmissions, the throughput referenced in the minimum requirements is the sum of throughputs of all codewords.

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.

The measurement channels in the following clauses are applicable only to FDD.

A.2.2 Reference measurement channels for FDD

A.2.2.1 DFT-s-OFDM Pi/2-BPSK

Table A.2.2.1-1: Reference Channels for DFT-s-OFDM Pi/2-BPSK

Parameter	Allocated resource blocks (L_{CRB})	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit					Bits	Bits			Bits	
	1	11	pi/2 BPSK	0	24	16	2	1	132	132
	5	11	pi/2 BPSK	0	160	16	2	1	660	660
	9	11	pi/2 BPSK	0	288	16	2	1	1188	1188
	10	11	pi/2 BPSK	0	320	16	2	1	1320	1320
	12	11	pi/2 BPSK	0	384	16	2	1	1584	1584
	15	11	pi/2 BPSK	0	480	16	2	1	1980	1980
	18	11	pi/2 BPSK	0	576	16	2	1	2376	2376
	24	11	pi/2 BPSK	0	768	16	2	1	3168	3168
	25	11	pi/2 BPSK	0	808	16	2	1	3300	3300
	30	11	pi/2 BPSK	0	984	16	2	1	3960	3960
	32	11	pi/2 BPSK	0	1032	16	2	1	4224	4224
	36	11	pi/2 BPSK	0	1128	16	2	1	4752	4752
	45	11	pi/2 BPSK	0	1416	16	2	1	5940	5940
	50	11	pi/2 BPSK	0	1544	16	2	1	6600	6600
	60	11	pi/2 BPSK	0	1864	16	2	1	7920	7920
	64	11	pi/2 BPSK	0	2024	16	2	1	8448	8448
	75	11	pi/2 BPSK	0	2408	16	2	1	9900	9900
	80	11	pi/2 BPSK	0	2472	16	2	1	10560	10560
	81	11	pi/2 BPSK	0	2536	16	2	1	10692	10692
	90	11	pi/2 BPSK	0	2792	16	2	1	11880	11880
	100	11	pi/2 BPSK	0	3104	16	2	1	13200	13200

NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [16].
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: The RMCs apply to all channel bandwidth where $L_{CRB} \leq N_{RB}$.

A.2.2.2 DFT-s-OFDM QPSK

Table A.2.2.2-1: Reference Channels for DFT-s-OFDM QPSK

Parameter	Allocated resource blocks (L_{CRB})	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit					Bits	Bits			Bits	
	1	11	QPSK	2	48	16	2	1	264	132
	5	11	QPSK	2	256	16	2	1	1320	660
	9	11	QPSK	2	456	16	2	1	2376	1188
	10	11	QPSK	2	504	16	2	1	2640	1320
	12	11	QPSK	2	608	16	2	1	3168	1584
	15	11	QPSK	2	768	16	2	1	3960	1980
	18	11	QPSK	2	928	16	2	1	4752	2376
	20	11	QPSK	2	1032	16	2	1	5280	2640
	24	11	QPSK	2	1192	16	2	1	6336	3168
	25	11	QPSK	2	1256	16	2	1	6600	3300
	30	11	QPSK	2	1544	16	2	1	7920	3960
	32	11	QPSK	2	1608	16	2	1	8448	4224
	36	11	QPSK	2	1800	16	2	1	9504	4752
	45	11	QPKS	2	2208	16	2	1	11880	5940
	50	11	QPSK	2	2472	16	2	1	13200	6600
	60	11	QPSK	2	3104	16	2	1	15840	7920
	64	11	QPSK	2	3240	16	2	1	16896	8448
	75	11	QPSK	2	3752	16	2	1	19800	9900
	80	11	QPSK	2	3976	24	2	2	21120	10560
	81	11	QPSK	2	4040	24	2	2	21384	10692
	90	11	QPSK	2	4488	24	2	2	23760	11880
	100	11	QPSK	2	5000	24	2	2	26400	13200

NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [16].
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: The RMCs apply to all channel bandwidth where $L_{CRB} \leq N_{RB}$.

A.2.2.3 DFT-s-OFDM 16QAM

Table A.2.2.3-1: Reference Channels for DFT-s-OFDM 16QAM

Parameter	Allocated resource blocks (L_{CRB})	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit					Bits	Bits			Bits	
	1	11	16QAM	10	176	16	2	1	528	132
	5	11	16QAM	10	888	16	2	1	2640	660
	9	11	16QAM	10	1608	16	2	1	4752	1188
	10	11	16QAM	10	1800	16	2	1	5280	1320
	12	11	16QAM	10	2088	16	2	1	6336	1584
	15	11	16QAM	10	2664	16	2	1	7920	1980
	18	11	16QAM	10	3240	16	2	1	9504	2376
	24	11	16QAM	10	4224	24	1	1	12672	3168
	25	11	16QAM	10	4352	24	1	1	13200	3300
	30	11	16QAM	10	5248	24	1	1	15840	3960
	32	11	16QAM	10	5632	24	1	1	16896	4224
	36	11	16QAM	10	6272	24	1	1	19008	4752
	45	11	16QAM	10	7808	24	1	1	23760	5940
	50	11	16QAM	10	8712	24	1	2	26400	6600
	60	11	16QAM	10	10504	24	1	2	31680	7920
	64	11	16QAM	10	11272	24	1	2	33792	8448
	75	11	16QAM	10	13064	24	1	2	39600	9900
	80	11	16QAM	10	14088	24	1	2	42240	10560
	81	11	16QAM	10	14088	24	1	2	42768	10692
	90	11	16QAM	10	15880	24	1	2	47520	11880
	100	11	16QAM	10	17424	24	1	3	52800	13200

NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [16].
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: The RMCs apply to all channel bandwidth where $L_{CRB} \leq N_{RB}$.

A.2.2.4 DFT-s-OFDM 64QAM

Table A.2.2.4-1: Reference Channels for DFT-s-OFDM 64QAM

Parameter	Allocated resource blocks (L_{CRB})	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit					Bits	Bits			Bits	
	1	11	64QAM	18	408	16	2	1	792	132
	5	11	64QAM	18	2024	16	2	1	3960	660
	9	11	64QAM	18	3624	16	2	1	7128	1188
	10	11	64QAM	18	3968	24	1	1	7920	1320
	12	11	64QAM	18	4736	24	1	1	9504	1584
	15	11	64QAM	18	6016	24	1	1	11880	1980
	18	11	64QAM	18	7168	24	1	1	14256	2376
	24	11	64QAM	18	9480	24	1	2	19008	3168
	25	11	64QAM	18	9992	24	1	2	19800	3300
	30	11	64QAM	18	12040	24	1	2	23760	3960
	32	11	64QAM	18	12808	24	1	2	25344	4224
	36	11	64QAM	18	14344	24	1	2	28512	4752
	45	11	64QAM	18	17928	24	1	3	35640	5940
	50	11	64QAM	18	19968	24	1	3	39600	6600
	60	11	64QAM	18	24072	24	1	3	47520	7920
	64	11	64QAM	18	25608	24	1	4	50688	8448
	75	11	64QAM	18	30216	24	1	4	59400	9900
	80	11	64QAM	18	31752	24	1	4	63360	10560
	81	11	64QAM	18	32264	24	1	4	64152	10692
	90	11	64QAM	18	35856	24	1	5	71280	11880
	100	11	16QAM	10	17424	24	1	3	52800	13200

NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
NOTE 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [16].
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: The RMCs apply to all channel bandwidth where $L_{CRB} \leq N_{RB}$.

A.2.2.5 DFT-s-OFDM 256QAM

Table A.2.2.5-1: Reference Channels for DFT-s-OFDM 256QAM

Parameter	Allocated resource blocks (L_{CRB})	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit					Bits	Bits			Bits	
	1	11	256QAM	20	704	16	2	1	1056	132
	5	11	256QAM	20	3496	16	2	1	5280	660
	9	11	256QAM	20	6272	24	1	1	9504	1188
	10	11	256QAM	20	7040	24	1	1	10560	1320
	12	11	256QAM	20	8456	24	1	2	12672	1584
	15	11	256QAM	20	10504	24	1	2	15840	1980
	18	11	256QAM	20	12552	24	1	2	19008	2376
	24	11	256QAM	20	16896	24	1	3	25344	3168
	25	11	256QAM	20	17424	24	1	3	26400	3300
	30	11	256QAM	20	21000	24	1	3	31680	3960
	32	11	256QAM	20	22536	24	1	3	33792	4224
	36	11	256QAM	20	25104	24	1	3	38016	4752
	45	11	256QAM	20	31752	24	1	4	47520	5940
	50	11	256QAM	20	34816	24	1	5	52800	6600
	60	11	256QAM	20	42016	24	1	5	63360	7920
	64	11	256QAM	20	45096	24	1	6	67584	8448
	75	11	256QAM	20	53288	24	1	7	79200	9900
	80	11	256QAM	20	56368	24	1	7	84480	10560
	81	11	256QAM	20	57376	24	1	7	85536	10692
	90	11	256QAM	20	63528	24	1	8	95040	11880
	100	11	256QAM	20	69672	24	1	9	105600	13200

NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
NOTE 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [16].
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: The RMCs apply to all channel bandwidth where $L_{CRB} \leq N_{RB}$.

A.2.2.6 CP-OFDM QPSK

Table A.2.2.6-1: Reference Channels for CP-OFDM QPSK

Parameter	Allocated resource blocks (L_{CRB})	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit					Bits	Bits			Bits	
	1	11	QPSK	2	48	16	2	1	264	132
	5	11	QPSK	2	256	16	2	1	1320	660
	6	11	QPSK	2	304	16	2	1	1584	792
	9	11	QPSK	2	456	16	2	1	2376	1188
	10	11	QPSK	2	504	16	2	1	2640	1320
	11	11	QPSK	2	552	16	2	1	2904	1452
	12	11	QPSK	2	608	16	2	1	3168	1584
	13	11	QPSK	2	672	16	2	1	3432	1716
	15	11	QPSK	2	768	16	2	1	3960	1980
	16	11	QPSK	2	808	16	2	1	4224	2112
	18	11	QPSK	2	928	16	2	1	4752	2376
	19	11	QPSK	2	984	16	2	1	5016	2508
	24	11	QPSK	2	1192	16	2	1	6336	3168
	25	11	QPSK	2	1256	16	2	1	6600	3300
	26	11	QPSK	2	1288	16	2	1	6864	3432
	31	11	QPSK	2	1544	16	2	1	8184	4092
	33	11	QPSK	2	1672	16	2	1	8712	4356
	38	11	QPSK	2	1928	16	2	1	10032	5016
	39	11	QPSK	2	2024	16	2	1	10296	5148
	40	11	QPSK	2	2024	16	2	1	10560	5280
	47	11	QPSK	2	2408	16	2	1	12408	6204
	51	11	QPSK	2	2536	16	2	1	13464	6732
	52	11	QPSK	2	2600	16	2	1	13728	6864
	53	11	QPSK	2	2664	16	2	1	13992	6996
	54	11	QPSK	2	2664	16	2	1	14256	7128
	61	11	QPSK	2	3104	16	2	1	16104	8052
	65	11	QPSK	2	3240	16	2	1	17160	8580
	67	11	QPSK	2	3368	16	2	1	17688	8844
	68	11	QPSK	2	3368	16	2	1	17952	8976
	78	11	QPSK	2	3848	24	2	2	20592	10296
	79	11	QPSK	2	3912	24	2	2	20856	10428
	80	11	QPSK	2	3976	24	2	2	21120	10560
	81	11	QPSK	2	4040	24	2	2	21384	10692
	93	11	QPSK	2	4616	24	2	2	24552	12276
	95	11	QPSK	2	4744	24	2	2	25080	12540

Parameter	Allocated resource blocks (L_{CRB})	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
	106	11	QPSK	2	5256	24	2	2	27984	13992
NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted. NOTE 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [16]. 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: The RMCs apply to all channel bandwidth where $L_{CRB} \leq N_{RB}$.										

A.2.2.7 CP-OFDM 16QAM

Table A.2.2.7-1: Reference Channels for CP-OFDM 16QAM

Parameter	Allocated resource blocks (L_{CRB})	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit					Bits	Bits			Bits	
	1	11	16QAM	10	176	16	2	1	528	132
	5	11	16QAM	10	888	16	2	1	2640	660
	6	11	16QAM	10	1064	16	2	1	3168	792
	9	11	16QAM	10	1608	16	2	1	4752	1188
	10	11	16QAM	10	1800	16	2	1	5280	1320
	11	11	16QAM	10	1928	16	2	1	5808	1452
	12	11	16QAM	10	2088	16	2	1	6336	1584
	13	11	16QAM	10	2280	16	2	1	6864	1716
	15	11	16QAM	10	2664	16	2	1	7920	1980
	16	11	16QAM	10	2792	16	2	1	8448	2112
	18	11	16QAM	10	3240	16	2	1	9504	2376
	19	11	16QAM	10	3368	16	2	1	10032	2508
	24	11	16QAM	10	4224	24	1	1	12672	3168
	25	11	16QAM	10	4352	24	1	1	13200	3300
	26	11	16QAM	10	4480	24	1	1	13728	3432
	31	11	16QAM	10	5376	24	1	1	16368	4092
	33	11	16QAM	10	5760	24	1	1	17424	4356
	38	11	16QAM	10	6656	24	1	1	20064	5016
	39	11	16QAM	10	6784	24	1	1	20592	5148
	40	11	16QAM	10	7040	24	1	1	21120	5280
	47	11	16QAM	10	8192	24	1	1	24816	6204

Parameter	Allocated resource blocks (L_{CRB})	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
	51	11	16QAM	10	8968	24	1	2	26928	6732
	52	11	16QAM	10	9224	24	1	2	27456	6864
	53	11	16QAM	10	9224	24	1	2	27984	6996
	54	11	16QAM	10	9480	24	1	2	28512	7128
	61	11	16QAM	10	10760	24	1	2	32208	8052
	65	11	16QAM	10	11272	24	1	2	34320	8580
	67	11	16QAM	10	11784	24	1	2	35376	8844
	68	11	16QAM	10	11784	24	1	2	35904	8976
	78	11	16QAM	10	13576	24	1	2	41184	10296
	79	11	16QAM	10	13832	24	1	2	41712	10428
	80	11	16QAM	10	14088	24	1	2	42240	10560
	81	11	16QAM	10	14088	24	1	2	42768	10692
	93	11	16QAM	10	16392	24	1	2	49404	12276
	95	11	16QMA	10	16392	24	1	2	50160	12540
	106	11	16QAM	10	18432	24	1	3	55968	13992

NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
NOTE 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [16].
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: The RMCs apply to all channel bandwidth where $L_{CRB} \leq N_{RB}$.

A.2.2.8 CP-OFDM 64QAM

Table A.2.2.8-1: Reference Channels for CP-OFDM 64QAM

Parameter	Allocated resource blocks (L_{CRB})	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit					Bits	Bits			Bits	
	1	11	64QAM	19	408	16	2	1	792	132
	5	11	64QAM	19	2024	16	2	1	3960	660
	9	11	64QAM	19	3624	16	2	1	7128	1188
	10	11	64QAM	19	3968	24	1	1	7920	1320
	11	11	64QAM	19	4352	24	1	1	8712	1452
	12	11	64QAM	19	4736	24	1	1	9504	1584
	13	11	64QAM	19	5120	24	1	1	10296	1716

	15	11	64QAM	19	6016	24	1	1	11880	1980
	18	11	64QAM	19	7168	24	1	1	14256	2376
	19	11	64QAM	19	7552	24	1		15048	2508
	24	11	64QAM	19	9480	24	1	2	19008	3168
	25	11	64QAM	19	9992	24	1	2	19800	3300
	26	11	64QAM	19	10504	24	1	2	20592	3432
	31	11	64QAM	19	12296	24	1	2	24552	4092
	33	11	64QAM	19	13064	24	1	2	26136	4356
	38	11	64QAM	19	15112	24	1	2	30096	5016
	39	11	64QAM	19	15624	24	1	2	30888	5148
	47	11	64QAM	19	18960	24	1	3	37224	6204
	51	11	64QAM	19	20496	24	1	3	40392	6732
	52	11	64QAM	19	21000	24	1	3	41184	6864
	53	11	64QAM	19	21000	24	1	3	41976	6996
	61	11	64QAM	19	24567	24	1	3	48312	8052
	65	11	64QAM	19	26120	24	1	4	51480	8580
	67	11	64QAM	19	26632	24	1	4	53064	8844
	78	11	64QAM	19	31240	24	1	4	61776	10296
	79	11	64QAM	19	31752	24	1	4	62568	10428
	80	11	64QAM	19	31752	24	1	4	63360	10560
	81	11	64QAM	19	32264	24	1	4	64152	10692
	93	11	64QAM	19	36896	24	1	5	73656	12276
	95	11	64QAM	19	37896	24	1	5	75240	12540
	106	11	64QAM	19	42016	24	1	5	83952	13992

NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
NOTE 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [16].
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: The RMCs apply to all channel bandwidth where $L_{CRB} \leq N_{RB}$.

A.2.2.9 CP-OFDM 256QAM

Table A.2.2.9-1: Reference Channels for CP-OFDM 256QAM

Parameter	Allocated resource blocks (L_{CRB})	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit					Bits	Bits			Bits	
	1	11	256QAM	20	704	16	2	1	1056	132
	5	11	256QAM	20	3496	16	2	1	5280	660

Parameter	Allocated resource blocks (L_{CRB})	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
	9	11	256QAM	20	6272	24	1	1	9504	1188
	10	11	256QAM	20	7040	24	1	1	10560	1320
	11	11	256QAM	20	7680	24	1	1	11616	1452
	12	11	256QAM	20	8456	24	1	2	12672	1584
	13	11	256QAM	20	9224	24	1	2	13728	1716
	15	11	256QAM	20	10504	24	1	2	15840	1980
	18	11	256QAM	20	12552	24	1	2	19008	2376
	19	11	256QAM	20	13320	24	1	2	20064	2508
	24	11	256QAM	20	16896	24	1	3	25344	3168
	25	11	256QAM	20	17424	24	1	3	26400	3300
	26	11	256QAM	20	18432	24	1	3	27456	3432
	31	11	256QAM	20	22032	24	1	3	32736	4092
	33	11	256QAM	20	23040	24	1	3	34848	4356
	38	11	256QAM	20	26632	24	1	4	40128	5016
	39	11	256QAM	20	27656	24	1	4	41184	5148
	47	11	256QAM	20	32776	24	1	4	49632	6204
	51	11	256QAM	20	35856	24	1	5	53856	6732
	52	11	256QAM	20	36896	24	1	5	54912	6864
	53	11	256QAM	20	36896	24	1	5	55968	6996
	61	11	256QAM	20	43032	24	1	6	64416	8052
	65	11	256QAM	20	46104	24	1	6	68640	8580
	67	11	256QAM	20	47112	24	1	6	70752	8844
	78	11	256QAM	20	55304	24	1	7	82368	10296
	79	11	256QAM	20	55304	24	1	7	83424	10428
	80	11	256QAM	20	56368	24	1	7	84480	10560
	81	11	256QAM	20	57376	24	1	7	85536	10692
	93	11	256QAM	20	65576	24	1	8	98208	12276
	95	11	256QAM	20	67584	24	1	8	100320	12540
	106	11	256QAM	20	73776	24	1	9	111936	13992

NOTE 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
NOTE 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [16].
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: The RMCs apply to all channel bandwidth where $L_{CRB} \leq N_{RB}$.

A.3 DL reference measurement channels

A.3.1 General

The transport block size (TBS) determination procedure is described in clause 5.1.3.2 of TS 38.214 [16].

Unless otherwise stated, no user data is scheduled on slot #0 within 20 ms in order to avoid SSB and PDSCH transmissions in one slot and simplify test configuration.

A.3.2 Reference measurement channels for PDSCH performance requirements

A.3.2.0 General

For PDSCH reference channels 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.3.2.1 FDD

A.3.2.1.1 Reference measurement channels for SCS 15 kHz FR1

Table A.3.2.1.1-1: PDSCH Reference Channel for FDD (QPSK)

Parameter	Unit	Value				
Reference channel		R.PDSCH.1-1.1 FDD				
Channel bandwidth	MHz	10				
Subcarrier spacing	kHz	15				
Number of allocated resource blocks	PRBs	52				
Number of consecutive PDSCH symbols		12				
Allocated slots per 2 frames	Slots	19				
MCS table		64QAM				
MCS index		4				
Modulation		QPSK				
Target Coding Rate		0.30				
Number of MIMO layers		1				
Number of DMRS REs		12				
Overhead for TBS determination		0				
Information Bit Payload per Slot						
For Slot i = 0	Bits	N/A				
For Slots i = 1,…, 19	Bits	4,096				
Transport block CRC per Slot						
For Slot i = 0	Bits	N/A				
For Slots i = 1,…, 19	Bits	24				
Number of Code Blocks per Slot						
For Slot i = 0	CBs	N/A				
For Slots i = 1,…, 19	CBs	1				
Binary Channel Bits Per Slot						
For Slot i = 0	Bits	N/A				
For Slots i = 10, 11	Bits	13,104				
For Slots i =1,…, 9, 12, …, 19	Bits	13,728				
Max. Throughput averaged over 2 frames	Mbps	3.891				
NOTE 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms NOTE 2: Slot i is slot index per 2 frames						

Table A.3.2.1.1-2: PDSCH Reference Channel for FDD (16QAM)

Parameter	Unit	Value					
Reference channel		R.PDSCH.1-2.1 FDD					
Channel bandwidth	MHz	10					
Subcarrier spacing	kHz	15					
Number of allocated resource blocks	PRBs	52					
Number of consecutive PDSCH symbols		12					
Allocated slots per 2 frames	Slots	19					
MCS table		64QAM					
MCS index		13					
Modulation		16QAM					
Target Coding Rate		0.48					
Number of MIMO layers		1					
Number of DMRS REs		12					
Overhead for TBS determination		0					
Information Bit Payload per Slot							
For Slot i = 0	Bits	N/A					
For Slots i = 1,…, 19	Bits	13,064					
Transport block CRC per Slot							
For Slot i = 0	Bits	N/A					
For Slots i = 1,…, 19	Bits	24					
Number of Code Blocks per Slot							
For Slot i = 0	CBs	N/A					
For Slots i = 1,…, 19	CBs	2					
Binary Channel Bits Per Slot							
For Slot i = 0	Bits	N/A					
For Slots i = 10, 11	Bits	26,208					
For Slots i = 1,…, 9, 12, …, 19	Bits	27,456					
Max. Throughput averaged over 2 frames	Mbps	12.411					
NOTE 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms NOTE 2: Slot i is slot index per 2 frames							

A.4 Testing related to Satellite Access

A.4.1 General

The following test conditions should be maintained for Satellite Access when test equipment emulates the snapshot of the satellite link channel.

- The same ephemeris info will be maintained during each test.
- A set of ephemeris information are pre-defined for each satellite corresponding to respective epoch times in TS 38.508-1 [12].
- The range of the selected constant delay shift is as follows:
  - For NGSO an altitude of 600 km and 1200 km on a circular orbit are considered. The range of the one-way delay between UE and satellite is from 2ms (lowest value for LEO orbit 600km) to 6.67 ms (highest value for LEO orbit 1200 km).
  - For GSO the range of the one-way delay from UE to satellite is within 119.375 ms to 128.79 ms.
- Constant delay value is derived from ephemeris info (SIB19) and UE location associated to zero Doppler or non-zero Doppler value under test.

A.4.2 Test condition for transmitter characteristics

All requirements in clause 6 for transmitter characteristics, other than frequency error in clause 6.4.1 shall be verified when Doppler conditions are set to zero and delay conditions are set to constant for all types of satellites.

Frequency error requirement in clause 6.4.1 shall be verified for at least two cases: one with zero Doppler condition and the other one with a constant Doppler shift where the range of the absolute value of Doppler is greater than zero and up to [0.93] ppm if the IE field *ntn-ScenarioSupport-r17* is present and indicated as GSO and up to 24 ppm if the IE field *ntn-ScenarioSupport-r17* is present and indicated as NGSO or only the IE field *nonTerrestrialNetwork-r17* is present. The delay condition is a constant.

A.4.3 Test condition for receiver characteristics

All requirements in clause 7 for receiver characteristics shall be verified when Doppler conditions are set to zero and delay conditions are set to constant for all types of satellites.

A.4.4 Test condition for performance requirements

All requirements in clause 8 for performance requirements shall be verified when Doppler conditions related to satellite motion for DL in service link are set to zero and delay conditions are set to constant for all types of NGSO satellites.

The one-way delay between UE and satellite for NGSO at an altitude of 600 km is 2 ms.

Annex B: (normative): Propagation conditions

B.0 No interference

The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects.

B.1 Static propagation condition

B.1.1 UE Receiver with 1Rx

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = [1 \quad 1].$$

B.1.2 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

$$\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}.$$

B.2 Multi-path fading propagation conditions

B.2.0 General

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.

Initial channel matrix for LOS component of NTN-TDL-C channel model is equal to channel matrix of Static propagation conditions in Clause B.1.

B.2.1 Delay profiles

The delay profiles are derived from the TR 38.811 [x] NTN-TDL models for the desired delay spread and tap resolution. After scaling the normalized delay spread values for each tap by the desired RMS delay spread, the tap delays are quantized to a delay resolution of 5ns by rounding to the nearest multiple of the delay resolution.

Table B.2.1-1: Delay profiles for NR NTN channel models

Type	Model	Delay spread (r.m.s.)	Delay resolution
NLOS	NTN-TDLA100	100 ns	5 ns
LOS	NTN-TDLC5	5 ns	5 ns

Table B.2.1-2: NTN-TDLA100 (DS = 100 ns)

Tap #	Delay [ns]	Power [dB]	Fading distribution
1	0	0	Rayleigh
2	110	-4.7	Rayleigh
3	285	-6.5	Rayleigh

Table B.2.1-3: NTN-TDLC5 (DS = 5 ns)

Tap #	Delay [ns]	Power [dB]	Fading distribution
1	0	-0.6	LOS path
	0	-8.9	Rayleigh
2	60	-21.5	Rayleigh
NOTE 1: Tap #1 follows a Rician distribution.			

B.2.2 Combinations of channel model parameters

The propagation conditions used for the performance measurements in multi-path fading environment are indicated as a combination of a channel model name and a maximum Doppler frequency, i.e., NTN-TDLA<DS>-<Doppler>, or NTN-TDLC<DS>-<Doppler> where '<DS>' indicates the desired delay spread and '<Doppler>' indicates the maximum Doppler frequency (Hz).

Table B.2.2-1 show the propagation conditions that are used for the performance measurements in multi-path fading environment for NLOS and LOS propagation conditions.

Table B.2.2-1: Channel model parameters for NTN

Combination name	Model	Maximum Doppler frequency
NTN-TDLA100-200	NTN-TDLA100	200 Hz
NTN-TDLC5-200	NTN-TDLC5	200 Hz

B.2.3 MIMO Channel Correlation Matrices

B.2.3.0 General

The MIMO channel correlation matrices defined in clause B.2.3 apply for the antenna configuration using uniform linear arrays at both gNB and UE.

B.2.3.1 MIMO Correlation Matrices using Uniform Linear Array (ULA)

B.2.3.1.0 General

The MIMO channel correlation matrices defined in clause B.2.3.1.1 apply for the antenna configuration using uniform linear array (ULA) at both gNB and UE.

B.2.3.1.1 Definition of MIMO Correlation Matrices

Table B.2.3.1.1-1 defines the correlation matrix for the gNB.

Table B.2.3.1.1-1: gNB correlation matrix

	One antenna	Two antennas
gNB Correlation	$R_{gNB}=1$	$R_{gNB}=\begin{pmatrix}1 & \alpha\\ \alpha^* & 1\end{pmatrix}$

Table B.2.3.1.1-2 defines the correlation matrix for the UE:

Table B.2.3.1.1-2: UE correlation matrix

	One antenna	Two antennas
UE Correlation	$R_{UE}=1$	$R_{UE}=\begin{pmatrix}1 & \beta\\ \beta^* & \mathbf{1}\end{pmatrix}$

Table B.2.3.1.1-3 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 gNB and UE.

Table B.2.3.1.1-3: R_{spat} correlation matrices

1x2 case	$R_{spat} = R_{UE} = \begin{bmatrix}1 & \beta\\ \beta^* & 1\end{bmatrix}$
2x1 case	$R_{spat} = R_{gNB} = \begin{bmatrix}1 & \alpha\\ \alpha^* & 1\end{bmatrix}$
2x2 case	$R_{spat} = R_{gNB} \otimes R_{UE} = \begin{bmatrix}1 & \alpha\\ \alpha^* & 1\end{bmatrix} \otimes \begin{bmatrix}1 & \beta\\ \beta^* & 1\end{bmatrix} = \begin{bmatrix}1 & \beta & \alpha & \alpha\beta\\ \beta^* & 1 & \alpha\beta^* & \alpha\\ \alpha^* & \alpha^*\beta & 1 & \beta\\ \alpha^*\beta^* & \alpha^* & \beta^* & 1\end{bmatrix}$

B.2.3.1.2 MIMO Correlation Matrices at High, Medium and Low Level

The α and β for different correlation types are given in Table B.2.3.1.2-1.

Table B.2.3.1.2-1: The α and β parameters for ULA MIMO correlation matrices

Correlation Model	α	β
Low correlation	0	0

The correlation matrices low correlation are defined in Table B.2.3.1.2-2 below.

Table B.2.3.1.2-2: MIMO correlation matrices for low correlation

1x2 case	$R_{low}=\mathbf{I}_2$
2x1 case	$R_{low}=\mathbf{I}_2$
2x2 case	$R_{low}=\mathbf{I}_4$
NOTE: $\mathbf{I}_d$ is the $d\times d$ identity matrix.	

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 Setup (Conducted)

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
PDCCH
PDSCH
PBCH DMRS
PDCCH DMRS
PDSCH DMRS
CSI-RS

C.3 Connection (Conducted)

C.3.0 General

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 Performance requirements

Table C.3.1-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels, unless otherwise stated.

Table C.3.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Parameter	Unit	Value (Note 2)
SSS transmit power	W	Test specific
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH to SSS	dB	0
EPRE ratio of PBCH to PBCH DMRS	dB	0
EPRE ratio of PDCCH to SSS	dB	0
EPRE ratio of PDCCH to PDCCH DMRS	dB	0
EPRE ratio of PDSCH to SSS	dB	0
EPRE ratio of PDSCH to PDSCH DMRS	dB	Test specific (Note 1)
EPRE ratio of CSI-RS to SSS	dB	-10*log10(L) (Note 3)
EPRE ratio of OCNG to SSS	dB	0
EPRE ratio of PDCCH OCNG to SSS	dB	0
EPRE ratio of LTE CRS to NR SSS	dB	0 (Note 4)

NOTE 1: Value is derived from Table 4.1-1 in TS 38.214 [16] based on "Number of DM-RS CDM groups without data" and "DMRS Type" parameters specified for each test.
NOTE 2: The value is the energy of per RE for a single antenna port before pre-coding.
NOTE 3: $L \in \{1,2,4,8\}$ is the CDM group size of NZP CSI-RS specified for each test.
NOTE 4: It is only applicable to LTE-NR coexistence tests.

Annex D (normative): Characteristics of the interfering signal

D.1 General

Some RF performance requirements for the NR UE receiver are defined with interfering signals present in addition to the wanted signal.

For NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz, a modulated 5 MHz full bandwidth NR down link signal, and in some cases an additional CW signal, are used as interfering signal. And for some cases an additional CW signal is used.

D.2 Interference signals

Table D.2-1 describes the modulated interferer for different channel bandwidth options for NR band lower than 2700 MHz.

Table D.2-1: Description of modulated NR interferer for NR bands with F_{DL_high} < 2,700 MHz and F_{UL_high} < 2,700 MHz

	Channel bandwidth			
	5 MHz	**10MHz**	**15 MHz**	**20 MHz**
RB	NOTE 1			
$BW_{Interferer}$	5 MHz			
NOTE 1: The RB configured for interfering signal is the same as maximum RB number defined in Table 5.3.2-1 for each sub-carrier spacing.				

Annex F (normative): Measurement uncertainties and Test Tolerances

F.1 Acceptable uncertainty of Test System (normative)

F.1.0 General

The maximum acceptable uncertainty of the Test System is specified below for each test, where appropriate. The Test System shall enable the stimulus signals in the test case to be adjusted to within the specified range, and the equipment under test to be measured with an uncertainty not exceeding the specified values. All ranges and uncertainties are absolute values, and are valid for a confidence level of 95 %, unless otherwise stated.

A confidence level of 95 % is the measurement uncertainty tolerance interval for a specific measurement that contains 95 % of the performance of a population of test equipment.

For RF tests it should be noted that the uncertainties in clause F.1 apply to the Test System operating into a nominal 50 ohm load and do not include system effects due to mismatch between the DUT and the Test System.

The downlink signal uncertainties apply at each receiver antenna connector.

F.1.1 Measurement of test environments

The measurement accuracy of the UE test environments defined in TS 38.508-1 [12] subclause 4.1, Test environments shall be

- Pressure ±5 kPa.
- Temperature ±2 degrees.
- Relative Humidity ±5 %.
- DC Voltage ±1.0 %.
- AC Voltage ±1.5 %.
- Vibration 10 %.
- Vibration frequency 0.1 Hz.

The above values shall apply unless the test environment is otherwise controlled and the specification for the control of the test environment specifies the uncertainty for the parameter.

F.1.2 Measurement of transmitter

Table F.1.2-1: Maximum Test System Uncertainty for transmitter tests

Subclause	Maximum Test System Uncertainty	Derivation of Test System Uncertainty
6.3.1 Minimum output power	Same as clause 6.3.1 in TS 38.521-1 [2] for FDD band with f ≤ 3 GHz.	
6.3.2 Transmit OFF power	Same as clause 6.3.2 in TS 38.521-1 [2] for FDD band with f ≤ 3 GHz.	
6.4.1_1 Frequency error with GSO ephemeris	Same as clause 6.4.1 in TS 38.521-1 [2] for FDD band with f ≤ 3 GHz.	
6.4.1_2 Frequency error with NGSO ephemeris	Same as clause 6.4.1 in TS 38.521-1 [2] for FDD band with f ≤ 3 GHz.	
6.5.3.1 General spurious emissions	Same as clause 6.5.3.1 in TS 38.521-1 [2].	
6.5.3.2 Spurious emission for UE co-existence	Same as clause 6.5.3.2 in TS 38.521-1 [2].	
6.5.3.3 Additional spurious emissions	Same as clause 6.5.3.3 in TS 38.521-1 [2].	
6.5.4 Transmit intermodulation	Same as clause 6.5.4 in TS 38.521-1 [2].	

F.1.3 Measurement of receiver

Table F.1.3-1: Maximum Test System Uncertainty for receiver tests

Subclause	Maximum Test System Uncertainty	Derivation of Test System Uncertainty
7.3.2 Reference sensitivity power level	Same as clause 7.3.2 in TS 38.521-1 [2].	
7.4 Maximum input level	Same as clause 7.4 in TS 38.521-1 [2] for FDD band with f ≤ 3 GHz.	
7.5 Adjacent channel selectivity7.5 Adjacent channel selectivity	Same as clause 7.5 in TS 38.521-1 [2] for FDD band with "f ≤ 3.0 GHz".	Same as clause 7.5 in TS 38.521-1 [2]".
7.6.2 In-band blocking	Same as clause 7.6.2 in TS 38.521-1 [2] for FDD band with "f ≤ 3.0 GHz".	Same as clause 7.6.2 in TS 38.521-1 [2]".
7.6.3 Out of Band Blocking	Same as clause 7.6.3 in TS 38.521-1 [2] for FDD band with "f ≤ 3.0 GHz".	Same as clause 7.6.3 in TS 38.521-1 [2]".
7.6.4 Narrow band blocking	Same as clause 7.6.4 in TS 38.521-1 [2] for FDD band with "f ≤ 3.0 GHz".	Same as clause 7.6.4 in TS 38.521-1 [2]".
7.7 Spurious response	Same as clause 7.6.3 in TS 38.521-1 [2].	Same as clause 7.6.3.
7.8.2 Wide band Intermodulation	Same as clause 7.8.2 in TS 38.521-1 [2] for FDD band with "f ≤ 3.0 GHz".	Same as clause 7.8.2 in TS 38.521-1 [2]".
7.9 Spurious emissions	Same as clause 7.8.2 in TS 38.521-1 [2] with "f ≤ 12.75 GHz"	

F.1.4 Measurement of Demod Performance requirements

Table F.1.4-1: Maximum Test System Uncertainty for demodulation performance tests

Subclause	Maximum Test System Uncertainty	Derivation of Test System Uncertainty
8.2.1.2.2.1.1_1 2Rx FDD FR1 PDSCH Mapping Type A for Satellite Access	Same as clause 5.2.2.1.1_1 in TS 38.521-4 [14]	Same as clause 5.2.2.1.1_1 in TS 38.521-4 [14]

F.2 Interpretation of measurement results (normative)

The measurement results returned by the Test System are compared – without any modification – against the Test Requirements. The Test Requirement is defined as a threshold considered in a test to assess compliance of the device; it might be either equal ("Shared Risk" principle) or relaxed ("Never fail a good DUT" principle) compared to the corresponding core specification value by an amount defined in Annex F.3 as Test Tolerance.

The "Shared Risk" and the "Never fail a good DUT" principles are defined in Recommendation ITU-R M.1545.

The actual measurement uncertainty of the Test System for the measurement of each parameter shall be included in the test report.

The recorded value for the Test System uncertainty shall be, for each measurement, equal to or lower than the appropriate figure in clause F.1 of the present document.

If the Test System for a test is known to have a measurement uncertainty greater than that specified in clause F.1, it is still permitted to use this apparatus provided that an adjustment is made value as follows:

Any additional uncertainty in the Test System over and above that specified in clause F.1 shall be used to tighten the Test Requirement, making the test harder to pass. For some tests, for example receiver tests, this may require modification of stimulus signals. This procedure will ensure that a Test System not compliant with clause F.1does not increase the chance of passing a device under test where that device would otherwise have failed the test if a Test System compliant with clause F.1 had been used.

F.3 Test Tolerance and Derivation of Test Requirements (informative)

F.3.0 General

The Test Requirements in the present document have been calculated by relaxing the Minimum Requirements of the core specification using the Test Tolerances defined in this clause. When the Test Tolerance is zero, the Test Requirement will be the same as the Minimum Requirement. When the Test Tolerance is non-zero, the Test Requirements will differ from the Minimum Requirements, and the formula used for the relaxation is given in this clause.

The Test Tolerances are derived from Test System uncertainties, regulatory requirements and criticality to system performance. As a result, the Test Tolerances may sometimes be set to zero.

The test tolerances should not be modified for any reason e.g. to take account of commonly known test system errors (such as mismatch, cable loss, etc.).

The downlink Test Tolerances apply at each receiver antenna connector.

F.3.1 Measurement of test environments

The UE test environments are set to the values defined in TS 38.508-1 subclause 4.1, without any relaxation. The applied Test Tolerance is therefore zero.

F.3.2 Measurement of transmitter

Table F.3.2-1: Derivation of Test Requirements (Transmitter tests)

Sub clause	Test Tolerance (TT)	Formula for test requirement
6.3.1 Minimum output power	Same as clause 6.3.1 in TS 38.521-1 [2] for FDD band with f ≤ 3 GHz.	Minimum requirement + TT
6.3.2 Transmit OFF power	Same as clause 6.3.2 in TS 38.521-1 [2] for FDD band with f ≤ 3 GHz.	Minimum requirement + TT
6.4.1_1 Frequency error with GSO ephemeris	Same as clause 6.4.1 in TS 38.521-1 [2] for FDD band with f ≤ 3 GHz.	Modulated carrier frequency: Upper limit + TT, Lower limit – TT DL power: REFSENS + TT
6.4.1_2 Frequency error with NGSO ephemeris	Same as clause 6.4.1 in TS 38.521-1 [2] for FDD band with f ≤ 3 GHz.	Modulated carrier frequency: Upper limit + TT, Lower limit – TT DL power: REFSENS + TT
6.5.3.1 General spurious emissions	Same as clause 6.5.3.1 in TS 38.521-1 [2].	Minimum requirement + TT
6.5.3.2 Spurious emission for UE co-existence	Same as clause 6.5.3.2 in TS 38.521-1 [2].	Minimum requirement + TT
6.5.3.3 Additional spurious emissions	Same as clause 6.5.3.3 in TS 38.521-1 [2].	Minimum requirement + TT
6.5.4 Transmit intermodulation	Same as clause 6.5.4 in TS 38.521-1 [2].	Minimum requirement + TT

F.3.3 Measurement of receiver

Table F.3.3-1: Derivation of Test Requirements (Receiver tests)

Sub clause	Test Tolerance (TT)	Formula for test requirement
7.3.2 Reference sensitivity power level	Same as clause 7.3.2 in TS 38.521-1 [2].	Minimum requirement + TT
7.4 Maximum input level	Same as clause 7.4 in TS 38.521-1 [2] for FDD band with f ≤ 3GHz.	Maximum input level - TT
7.5 Adjacent channel selectivity	Same as clause 7.5 in TS 38.521-1 [2]".	Same as clause 7.5 in TS 38.521-1 [2]".
7.6.2 In-band blocking	Same as clause 7.6.2 in TS 38.521-1 [2]".	Same as clause 7.6.2 in TS 38.521-1 [2]".
7.6.3 Out of Band Blocking	Same as clause 7.6.3 in TS 38.521-1 [2]".	Same as clause 7.6.3 in TS 38.521-1 [2]".
7.6.4 Narrow band blocking	Same as clause 7.6.4 in TS 38.521-1 [2]".	Same as clause 7.6.4 in TS 38.521-1 [2]".
7.7 Spurious response	Same as clause 7.6.3 in TS 38.521-1 [2].	Same as clause 7.6.3.
7.8.2 Wide band Intermodulation	Same as clause 7.8.2 in TS 38.521-1 [2]".	Same as clause 7.8.2 in TS 38.521-1 [2]".
7.9 Spurious emissions	Same as clause 7.9 in TS 38.521-1 [2]".	Same as clause 7.9 in TS 38.521-1 [2]".

F.3.4 Measurement of Demod Performance requirements

Table F.3.4-1: Derivation of Test Requirements for demodulation performance tests

Sub clause	Test Tolerance (TT)	Formula for test requirement
8.2.1.2.2.1.1_1 2Rx FDD FR1 PDSCH Mapping Type A for Satellite Access	Same as clause 5.2.2.1.1_1 in TS 38.521-4 [14]	Same as clause 5.2.2.1.1_1 in TS 38.521-4 [14]

F.4 Uplink power window

F.4.1 Introduction

A number of Tx and Rx Test cases set the UE uplink power to be within a defined window to ensure the test is carried out in the intended conditions. This clause gives the method for calculating the uplink power window used in Tx test cases and Rx Test cases.

F.4.2 Setting the power window above a requirement

Information from the core requirements in TS 38.101-1 [5], TS 38.213 [7] and the uncertainties in Annex F applicable to the Test case are used to derive the uplink power window. There are 4 stages:

- Find the uplink power target value.
- Determine how closely the uplink power can be set to the target value.
- Include the effect of test system uncertainty.
- Position the Uplink power window to ensure UE is not tested outside Core requirements.

This process is shown in the diagram below, using values for f ≤ 3 GHz and BW ≤ 40 MHz and taking an example where the target value is 0dBm (lower end of a UE Core requirement side condition range of 0 dBm ≤ Output power ≤ 10 dBm):

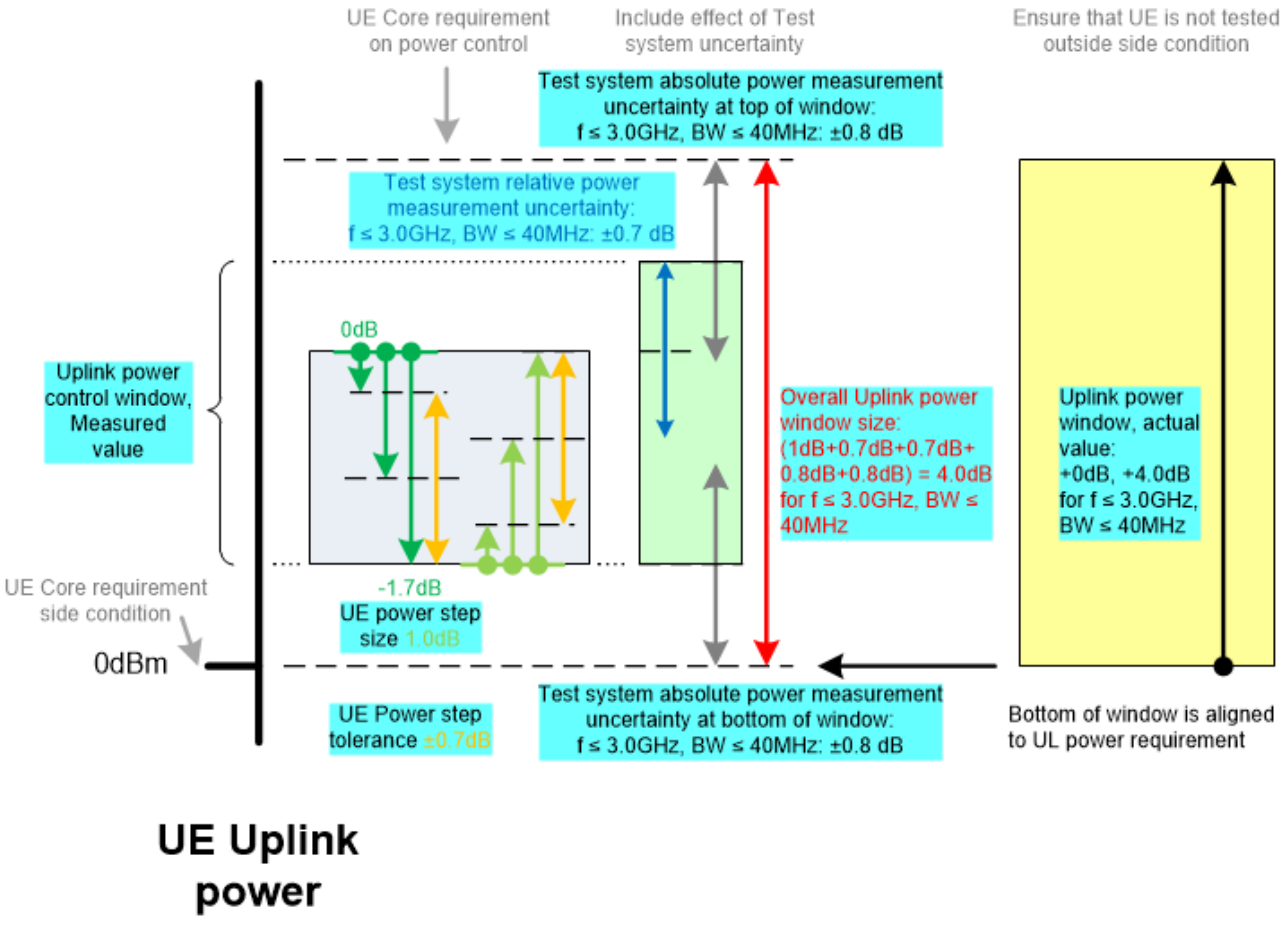

Figure F.4.2-1: Example uplink power setting to be above a requirement

The smallest UE Power step size is defined in TS 38.213 [7] Table 7.1.1-1, for absolute $\delta_{\mathrm{PUSCH},b,f,c}$.

The UE Power step size tolerance is defined in TS 38.101-1 [5] Table 6.3.4.3-1, 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, and for a power step $\Delta P \leq 1$ dB.

The Test system uncertainties are defined in Annex F of the present document.

To ensure that the actual UE uplink power is within the Uplink power window, UE uplink power measured by the test system should remain within the smaller Uplink power control window shown in Figure F.4.2-1.

F.4.3 Setting the power window below a requirement

Information from the core requirements in TS 38.101-1 [5], TS 38.213 [7] and the uncertainties in Annex F applicable to the Test case are used to derive the uplink power window. There are 4 stages:

- Find the uplink power target value.
- Determine how closely the uplink power can be set to the target value.
- Include the effect of test system uncertainty.
- Position the Uplink power window to ensure UE is not tested outside Core requirements.

This process is shown in the diagram below, using values for $f \leq 3$ GHz and BW ≤ 40 MHz and taking an example where the target value is 4 dB below PCMAX_L (UE Core requirement side condition):

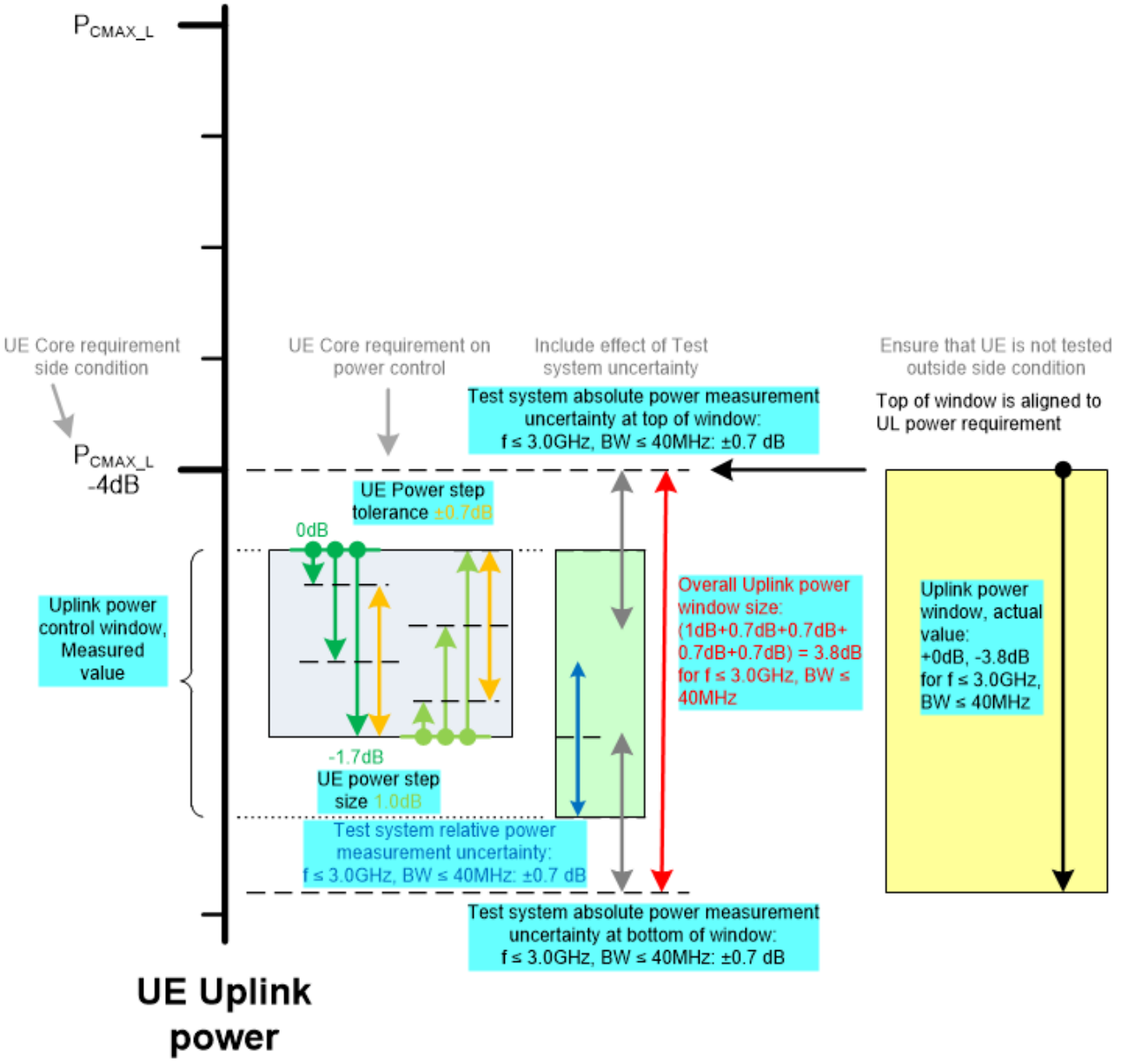

Figure F.4.3-1: Example uplink power setting to be below a requirement

The smallest UE Power step size is defined in TS 38.213 [7] Table 7.1.1-1, for absolute $\delta_{\mathrm{PUSCH},f,c}$.

The UE Power step size tolerance is defined in TS 38.101-1 [5] Table 6.3.4.3-1, 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, and for a power step $\Delta P \leq 1$ dB.

The Test system uncertainties are defined in Annex F of the present document.

To ensure that the actual UE uplink power is within the Uplink power window, UE uplink power measured by the test system should remain within the smaller Uplink power control window shown in Figure F.4.3-1.

F.4.4 Setting the power window centred on a target value

Information from the core requirements in TS 38.101-1 [5], TS 38.213 [7] and the uncertainties in Annex F applicable to the Test case are used to derive the uplink power window. There are 4 stages:

- Find the uplink power target value.

- Determine how closely the uplink power can be set to the target value.
- Include the effect of test system uncertainty.
- Position the Uplink power window centred on the target value.

This process is shown in the diagram below, using values for f ≤ 3 GHz and BW ≤ 40 MHz and taking an example where the target value is +10 dBm:

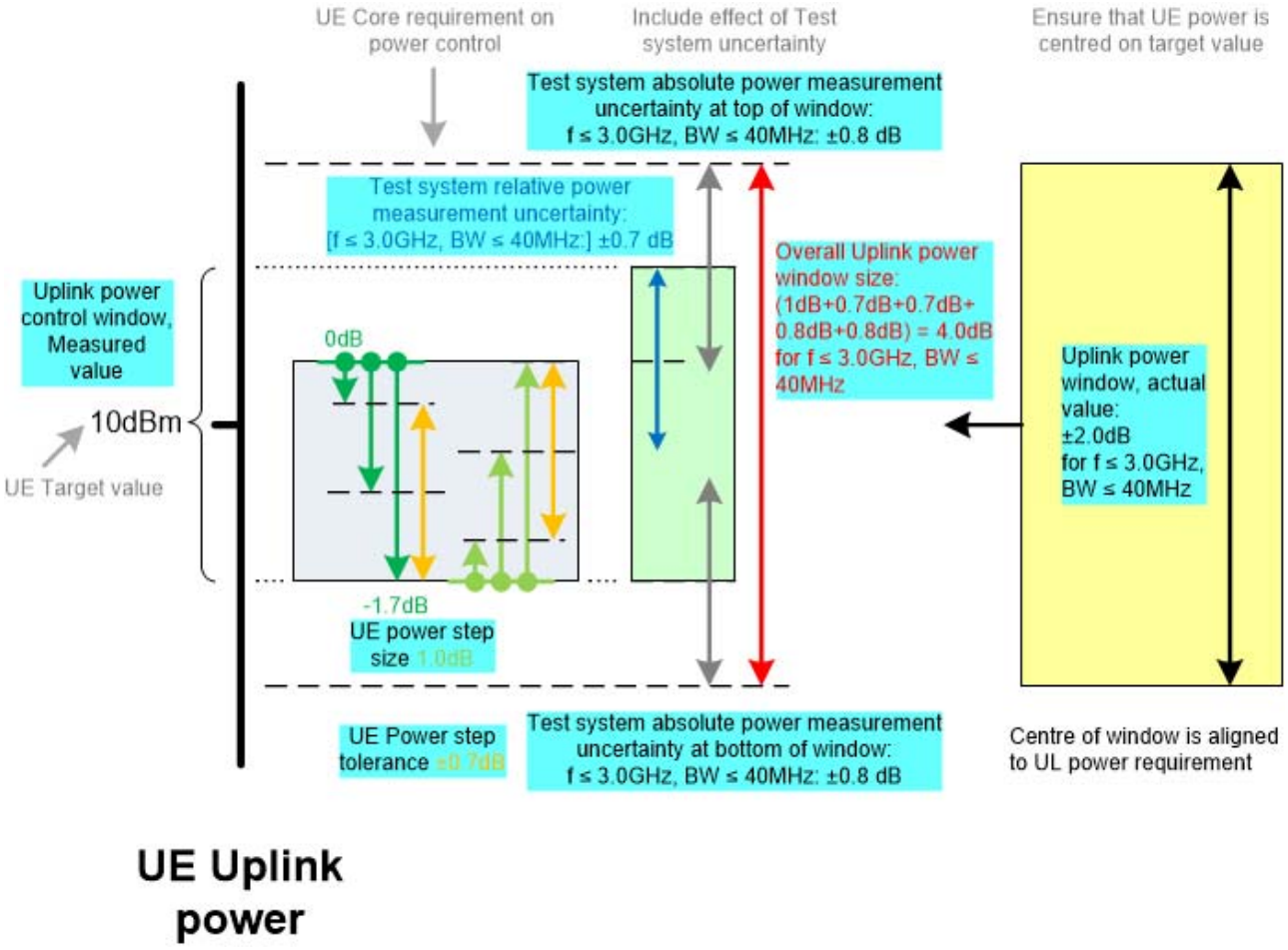

Figure F.4.4-1: Example NR FR1 uplink power setting centred on a target value

The smallest UE Power step size is defined in TS 38.213 [7] Table 7.1.1-1, for absolute $\delta_{\mathrm{PUSCH},b,f,c}$.

The UE Power step size tolerance is defined in TS 38.101-1 [5] Table 6.3.4.3-1, 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, and for a power step ΔP ≤ 1 dB.

The Test system uncertainties are defined in Annex F of the present document.

To ensure that the actual UE uplink power is centred on the target value, UE uplink power measured by the test system should remain within the smaller Uplink power control window shown in Figure F.4.4-1.

Annex H (normative): Statistical Testing

H.1 General

This annex specifies mapping throughput to error ratio, pass fail limits and pass fail decision rules that are needed for measuring average throughput for a duration sufficient to achieve statistical significance for testing receiver characteristics.

H.2 Statistical testing of receiver characteristics

H.2.1 General

The test of receiver characteristics is twofold.

1. A signal or a combination of signals is offered to the RX port(s) of the receiver.
2. The ability of the receiver to demodulate /decode this signal is verified by measuring the throughput.

In (2) is the statistical aspect of the test and is treated here.

The minimum requirement for all receiver tests is > 95 % of the maximum throughput.

All receiver tests are performed in static propagation conditions. No fading conditions are applied.

H.2.2 Mapping throughput to error ratio

a) The measured information bit throughput R is defined as the sum (in kilobits) of the information bit payloads successfully received during the test interval, divided by the duration of the test interval (in seconds).

b) In measurement practice the UE indicates successfully received information bit payload by signalling an ACK to the SS.
If payload is received, but damaged and cannot be decoded, the UE signals a NACK.

c) Only the ACK and NACK signals, not the data bits received, are accessible to the SS.
The number of bits is known in the SS from knowledge of what payload was sent.

d) For the reference measurement channel, applied for testing, the number of bits is different in different slots, however in a radio frame it is fixed during one test.

e) The time in the measurement interval is composed of successfully received slots (ACK), unsuccessfully received slots (NACK) and no reception at all (DTX-slots).

f) DTX-slots may occur regularly according the applicable reference measurement channel (regDTX).
In real live networks this is the time when other UEs are served. In TDD these are the UL and special slots.
regDTX vary from test to test but are fixed within the test.

g) Additional DTX-slots occur statistically when the UE is not responding ACK or NACK where it should. (statDTX)
This may happen when the UE was not expecting data or decided that the data were not intended for it.

The pass / fail decision is done by observing the:

- number of NACKs;
- number of ACKs; and
- number of statDTXs (regDTX is implicitly known to the SS).

The ratio (NACK + statDTX)/(NACK+ statDTX + ACK)is the Error Ratio (ER). Taking into account the time consumed by the ACK, NACK, and DTX-TTIs (regular and statistical), ER can be mapped unambiguously to throughput for any single reference measurement channel test.

H.2.3 Design of the test

The test is defined by the following design principles (see clause H.2.6, Theory….):

1. The early decision concept is applied.
2. A second limit is introduced: Bad DUT factor M>1
3. To decide the test pass:

   Supplier risk is applied based on the Bad DUT quality

   To decide the test fail

   Customer Risk is applied based on the specified DUT quality

The test is defined by the following parameters:

1. Limit ER = 0.05 (Throughput limit = 95%)
2. Bad DUT factor M=1.5 (selectivity)
3. Confidence level CL = 95% (for specified DUT and Bad DUT-quality)

H.2.4 Numerical definition of the pass fail limits

Table H.2.4-1: pass fail limits

ne	ns_p	ns_f	ne	ns_p	ns_f	ne	ns_p	ns_f	ne	ns_p	ns_f
0	67	NA	37	715	477	74	1290	1093	111	1847	1739
1	67	NA	38	731	493	75	1306	1110	112	1862	1756
2	95	NA	39	747	509	76	1321	1128	113	1877	1774
3	119	NA	40	763	525	77	1336	1145	114	1891	1792
4	141	NA	41	779	541	78	1351	1162	115	1906	1809
5	162	NA	42	795	557	79	1366	1179	116	1921	1827
6	183	NA	43	810	573	80	1382	1197	117	1936	1845
7	203	NA	44	826	590	81	1397	1214	118	1951	1863
8	222	NA	45	842	606	82	1412	1231	119	1966	1880
9	241	67	46	858	622	83	1427	1248	120	1981	1898
10	259	80	47	873	639	84	1442	1266	121	1995	1916
11	278	92	48	889	655	85	1457	1283	122	2010	1934
12	296	105	49	905	672	86	1472	1300	123	2025	1951
13	314	118	50	920	688	87	1487	1318	124	2040	1969
14	332	131	51	936	705	88	1503	1335	125	2055	1987
15	349	145	52	952	721	89	1518	1353	126	2069	2005
16	367	159	53	967	738	90	1533	1370	127	2084	2023
17	384	173	54	983	755	91	1548	1387	128	2099	2041
18	401	187	55	998	771	92	1563	1405	129	2114	2058
19	419	201	56	1014	788	93	1578	1422	130	2128	2076
20	436	216	57	1029	805	94	1593	1440	131	2143	2094
21	453	230	58	1045	822	95	1608	1457	132	2158	2112
22	469	245	59	1060	838	96	1623	1475	133	2173	2130
23	486	260	60	1076	855	97	1638	1492	134	2187	2148
24	503	275	61	1091	872	98	1653	1510	135	2202	2166
25	520	290	62	1107	889	99	1668	1527	136	2217	2183
26	536	305	63	1122	906	100	1683	1545	137	2232	2201
27	553	320	64	1137	923	101	1698	1562	138	2246	2219
28	569	335	65	1153	940	102	1713	1580	139	2261	2237
29	585	351	66	1168	957	103	1728	1598	140	2276	2255
30	602	366	67	1184	974	104	1742	1615	141	2291	2273
31	618	382	68	1199	991	105	1757	1633	142	2305	2291
32	634	398	69	1214	1008	106	1772	1650	143	2320	2309
33	651	413	70	1229	1025	107	1787	1668	144	2335	2327
34	667	429	71	1245	1042	108	1802	1686	145	2349	2345
35	683	445	72	1260	1059	109	1817	1703	146	2364	2363
36	699	461	73	1275	1076	110	1832	1721	*) note 2 in H.2.5		

NOTE 1: The first column is the number of errors (ne = number of NACK + statDTX).

NOTE 2: The second column is the number of samples for the pass limit (ns_p, ns=Number of Samples= number of NACK + statDTX + ACK).

NOTE 3: The third column is the number of samples for the fail limit (ns_f).

NOTE 4: The UE could be decided as early pass/fail when at least 67 samples are received. The ns_f is set to NA for ne less than 9.

H.2.5 Pass fail decision rules

The pass fail decision rules apply for a single measurement. A test case is passed only when all the measurements in the test case are passed.

Having observed 0 errors, pass the test at 67+ samples, otherwise continue

Having observed 1 error, pass the test at 95+ otherwise continue

Having observed 2 errors, pass the test at 119+ samples, otherwise continue

etc.

Having observed 14645 errors, pass the test at 23642349+ samples, fail the test at 2345- samples, otherwise continue

Having observed 152 errors, pass the test at + samples, fail the test at 2363- samples.

Where x+ means: x or more, x- means x or less.

NOTE 1: An ideal DUT passes after 67 samples. The maximum test time is 2364 samples.

NOTE 2: It is allowed to deviate from the early decision concept by postponing the decision (pass/fail or continue). Postponing the decision to or beyond the end of Table H.2.4-1 requires a pass fail decision against the test limit: pass the DUT for ER<0.0618, otherwise fail.

H.2.6 Theory to derive the pass fail limits (Informative)

Editor's note: This clause of the Annex H is for information only and it describes the background theory and information for statistical testing.

H.2.6.1 Numerical definition of the pass-fail limits

A statistical test is characterized by test time, selectivity and confidence level. The outcome of the statistical test is a decision. This decision may be correct, i.e., DUTs whose throughput is less than 95% maximum throughput being declared to fail, and DUTs whose throughput is higher or equal to 95% being declared to pass, or in-correct with opposite decision. The Confidence Level (CL) describes the probability that the decision is a correct one. The complement is the wrong decision probability (risk) D = 1-CL.

As described in H.2.2, the measurement of throughput could be mapped to ER (Error Ratio). When testing ER, transport blocks or "samples" are observed and the number of correctly and erroneously received blocks are recorded. For a "standard" test, a pre-defined number of samples are observed, and a pass/fail decision is made based on the number of observed errors being above/below a threshold. This threshold is based on the targeted throughput or BLER and the design target CL. There is always some risk of a statistical variation leading to an incorrect pass/fail decision. The greater the number of samples that are recorded, the lower is the risk of such an error. The number of samples that are observed in a standard test is dimensioned to achieve an acceptable low risk of error (i.e., an acceptable high confidence level) for DUTs that just meet the specified limit.

The standard test works well where the target ER level is relatively high and confidence level relatively low (both are chosen to be on a comparable order of magnitude). However, for relatively low ER testing the length of time required for observing sufficient samples to achieve a 95% confidence level is excessive. In many cases, the DUTs will in fact have a much lower true ER level than the target ER level, (in which case, the number of samples needed to achieve high confidence that the true ER level is lower than the limit is much smaller). On the other hand, a bad DUT which is expected to fail the requirement might have a much higher true ER level (in which case, errors occur more frequently and it can be demonstrated that the DUT is above the target ER limit with fewer samples).

To avoid long test time, an alternative test method called early pass/fail is adopted. With the early pass/fail, each time a block error is encountered, a decision is made on whether the DUT can be passed/failed with 95% CL or the test needs to continue until another error is encountered. In the case of very good DUTs, the test can also be passed, when the number of samples permissible for one error event is reached and no error event is recorded. Pass/Fail is decided based on the total number of observed samples and errors, and a statistical calculation based on an inverse binomial cumulative distribution. The calculation involves one parameter, one variable and the result:

- Parameter: d (per step decision probability).
- Variable: ne (number of observed errors).
- Result: ns (number of expected samples for pass/fail, depending on which one is calculated).

The per step decision probability risk, d, expresses the probability of making an incorrect pass/fail decision in the current step (i.e., for the current decision coordinate). d is determined by simulation such that the overall risk of making a wrong decision over all steps of each test of a large number of tests on a large number of DUTs that exactly meet the target ER limit is D=5% (and hence the CL 95%).

It should be noted that d is determined separately considering early pass and early fail testing.

For a marginal DUT (i.e., a DUT almost exactly meeting the target ER level), the unmodified early pass/early fail approach is unable to distinguish whether the DUT has just passed or just failed the BLER (ε→0), and can thus terminate with an "undecided" result. To avoid this undecided result and provide selectivity, a so-called "bad device factor" (M) is introduced into the early pass calculation. This factor biases the decision towards avoiding failing good DUT.

H.2.6.2 Simulation to derive the pass-fail limits for testing 95% throughput

As per the description in clause H.2.2, the 95% throughput measurement is mapped to ER=0.05, where ER is (NACK + statDTX)/(NACK+ statDTX + ACK).

The binomial distribution and its inverse are used to design the pass and fail limits. Note that this method is not unique and that other methods exist.

$$\mathrm{fail}\left(\mathrm{ne},\mathrm{d_f}\right):=\frac{\mathrm{ne}}{\mathrm{ns_f}}=\frac{\mathrm{ne}}{\left(\mathrm{ne}+\mathrm{qnbinom}\left(\mathrm{d_f},\mathrm{ne},\mathrm{ER}\right)\right)}$$

$$\mathrm{pass}\left(\mathrm{ne},\mathrm{cl_p},\mathrm{M}\right):=\frac{\mathrm{ne}}{\mathrm{ns_p}}=\frac{\mathrm{ne}}{\left(\mathrm{ne}+\mathrm{qnbinom}\left(\mathrm{cl_p},\mathrm{ne},\mathrm{ER}\cdot\mathrm{M}\right)\right)}$$

Where

- fail(..) is the error ratio for the fail limit.
- pass(..) is the error ratio for the pass limit.
- ER is the specified error ratio 5%.
- ne is the number of bad results. This is the variable in both equations.
- M is the Bad DUT factor M=1.5.
- d_f is the wrong decision probability of a single (ne, ns) co-ordinate for the fail limit.
  It is found by simulation to be $d_f = 0.006$.
- cl_p is the confidence level of a single (ne, ns) co-ordinate for the pass limit.
  It is found by simulation to be $cl_p = 0.9945$.
- qnbinom(..): The inverse cumulative function of the negative binomial distribution.

The simulation works as follows:

- A large population of limit DUTs with true ER = 0.05 is decided against the pass and fail limits.
- cl_p and d_f are tuned such that CL (95 %) of the population passes and D (5 %) of the population fails.
- A population of Bad DUTs with true ER = M*0.05 is decided against the same pass and fail limits.
- cl_p and d_f are tuned such that CL (95 %) of the population fails and D (5 %) of the population passes.
- The number of DUTs decrease during the simulation, as the decided DUTs leave the population. That number decreases with an approximately exponential characteristics. After 146 bad results all DUTs of the population are decided.

NOTE: The exponential decrease of the population is an optimal design goal for the decision co-ordinates (ne, ns), which can be achieved with other formulas or methods as well.

Annex I (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2022-11	RAN5#97	R5-226639	-	-	-	TP to add clause 1-3 to TS 38.521-5	0.0.0
2022-11	RAN5#97	R5-226640	-	-	-	TP to add clause 4 to TS 38.521-5	0.0.0
2022-11	RAN5#97	R5-226641	-	-	-	TP to add clause 5 to TS 38.521-5	0.0.0
2022-11	RAN5#97	R5-227885	-	-	-	Text proposal for section 6, 6.1 and 6.2.1 in TS 38.521-5	0.0.0
2022-11	RAN5#97	R5-227886	-	-	-	Text proposal for section 6.2.2 in TS 38.521-5	0.0.0
2023-03	RAN5#98	R5-231738	-	-	-	Definition of NTN minimum output power test case 6.3.1	0.0.1
2023-03	RAN5#98	R5-231739	-	-	-	Definition of NTN transmit OFF power test case 6.3.2	0.0.1
2023-03	RAN5#98	R5-231740	-	-	-	Introduction of new test case 7.9 Spurious emissions and addition of main structure of section 7	0.0.1
2023-03	RAN5#98	R5-231741	-	-	-	Introduction of general sections for demodulation performance test cases for NTN capable Ues	0.0.1
2023-03	RAN5#98	R5-231742	-	-	-	Introduction of demodulation performance test cases for NTN capable Ues	0.0.1
2023-03	RAN5#98	R5-230877	-	-	-	Introduction of 6.5.3.1 for TS38.521-5	0.0.1
2023-03	RAN5#98	R5-230878	-	-	-	Introduction of 7.1 7.2 and 7.3 for TS38.521-5	0.0.1
2023-03	RAN5#98	R5-230879	-	-	-	Introduction of 6.5.3.2 for TS38.521-5	0.0.1
2023-03	RAN5#98	R5-231854	-	-	-	Text configurations and requirements for section 6.2.1 and 6.2.2	0.0.1
2023-03	RAN5#98	R5-231367	-	-	-	Introduction of NTN TC 6.3.3 on Tx on-off time mask	0.0.1
2023-03	RAN5#98	R5-231368	-	-	-	Introduction of NTN TC 6.5.2.2 on Spectrum emission mask	0.0.1
2023-03	RAN5#98	R5-231369	-	-	-	Introduction of NTN TC 6.5.2.4 on ACLR	0.0.1
2023-03	RAN5#98	R5-231383	-	-	-	Introduction of NTN TC 7.6.3 on out of band blocking	0.0.1
2023-06	RAN5#99	R5-232346	-	-	-	Definition of NTN maximum input level test case 7.4	0.1.0
2023-06	RAN5#99	R5-233567	-	-	-	Introduction of new test case 7.5 Adjacent channel selectivity	0.1.0
2023-06	RAN5#99	R5-232372	-	-	-	Correction of referenced Annexes for test case 7.9 Spurious emissions	0.1.0
2023-06	RAN5#99	R5-233568	-	-	-	Introduction of new Annexes	0.1.0
2023-06	RAN5#99	R5-233569	-	-	-	Introduction of NTN AMPR tests	0.1.0
2023-06	RAN5#99	R5-232519	-	-	-	Introduction of NTN configured transmission power tests	0.1.0
2023-06	RAN5#99	R5-233570	-	-	-	TP to add 2Rx PDSCH mapping type A test case for NTN UE	0.1.0
2023-06	RAN5#99	R5-233158	-	-	-	Update General SE for NTN	0.1.0
2023-06	RAN5#99	R5-233571	-	-	-	Updates to NTN TC 6.3.3 on Tx on-off time mask	0.1.0
2023-06	RAN5#99	R5-233572	-	-	-	Updates to NTN TC 6.5.2.2 on Spectrum emission mask	0.1.0
2023-06	RAN5#99	R5-233573	-	-	-	Updates to NTN TC 6.5.2.4 on ACLR	0.1.0
2023-09	RAN5#100	R5-235824	-	-	-	MU and TT definition for NR NTN Min power and Off power test cases	1.0.0
2023-09	RAN5#100	R5-235825	-	-	-	MU and TT definition for NR NTN Maximum Input level test case	1.0.0
2023-09	RAN5#100	R5-234627	-	-	-	NTN AMPR test configurations and requirements	1.0.0
2023-09	RAN5#100	R5-234628	-	-	-	Editorial change to move 6.2.4 in 38.521-5	1.0.0
2023-09	RAN5#100	R5-235866	-	-	-	Update Ref sensitivity for NTN	1.0.0
2023-09	RAN5#100	R5-235826	-	-	-	Update TX Intermodulation for NTN	1.0.0
2023-09	RAN5#100	R5-235827	-	-	-	Update TX Spur co-exist for NTN	1.0.0
2023-09	RAN5#100	R5-235456	-	-	-	Clarifications to 38.521-5	1.0.0
2023-09	RAN5#100	R5-235186	-	-	-	Initial conditions update for multiple test cases	1.0.0
2023-09	RAN5#100	R5-235679	-	-	-	Updates to NTN TC 6.3.3 on Tx on-off time mask	1.0.0
2023-09	RAN5#100	R5-235683	-	-	-	Updates to NTN TC 6.5.2.2 on Spectrum emission mask	1.0.0
2023-09	RAN5#100	R5-235681	-	-	-	Updates to NTN TC 6.5.2.4 on ACLR	1.0.0
2023-12	RAN5#101	R5-237874	-	-	-	Addition of test configuration and error correction for 7.5 Adjacent channel selectivity	1.1.0
2023-12	RAN5#101	R5-237834	-	-	-	Introduction of new test cases 7.7 Spurious response	1.1.0
2023-12	RAN5#101	R5-237835	-	-	-	Introduction of new test cases 7.8 Intermodulation characteristics	1.1.0

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2023-12	RAN5#101	R5-237836	-	-	-	Addition of test configuration and error correction for 7.9 Spurious emissions	1.1.0
2023-12	RAN5#101	R5-236147	-	-	-	Introduction of Annex B.0	1.1.0
2023-12	RAN5#101	R5-236148	-	-	-	Introduction of Annex D Characteristics of the interfering signal	1.1.0
2023-12	RAN5#101	R5-236149	-	-	-	Introduction of measurement uncertainties and test tolerances for test cases from 7.5 to 7.9	1.1.0
2023-12	RAN5#101	R5-236150	-	-	-	Introduction of Annex F.4 Uplink power window	1.1.0
2023-12	RAN5#101	R5-236151	-	-	-	Introduction of Annex H Statistical Testing	1.1.0
2023-12	RAN5#101	R5-236291	-	-	-	Further clarification on NR NTN comformance requirement specifications	1.1.0
2023-12	RAN5#101	R5-237690	-	-	-	Adding Additional Spurious Emission TC for NTN	1.1.0
2023-12	RAN5#101	R5-237875	-	-	-	Adding Frequency Error TC for NTN	1.1.0
2023-12	RAN5#101	R5-237864	-	-	-	Core requirements alignment for NR NTN test cases	1.1.0
2023-12	RAN5#101	R5-237876	-	-	-	Update to Refsens test case 7.3.2 for NTN	1.1.0
2023-12	RAN5#101	R5-237877	-	-	-	Update to PDSCH demodulation test cases for NTN	1.1.0
2023-12	RAN#102	RP-233928	-	-	-	presented at RAN#102 for approval	2.0.0
2023-12	RAN#102	-	-	-	-	put under revision control as v17.0.0 with small editorial changes	17.0.0
2023-12	RAN#102	RP-232785	0001	-	F	Updates to spurious emissions UE coexistence test cases as part of introduction of Band 54	18.0.0
2024-03	RAN#103	R5-240840	0003	-	F	Corrections on 5.3.3 for minimum guardband and transmission bandwidth configuration	18.1.0
2024-03	RAN#103	R5-240841	0004	-	F	Corrections on 6.2.2 for maximum output power reduction	18.1.0
2024-03	RAN#103	R5-240843	0006	-	F	Corrections on 6.3.2 for Transmit OFF power	18.1.0
2024-03	RAN#103	R5-240846	0009	-	F	Corrections on 6.5.2 for out of band emission	18.1.0
2024-03	RAN#103	R5-240850	0013	-	F	Corrections on 7.4 for maximum input level	18.1.0
2024-03	RAN#103	R5-240851	0014	-	F	Corrections on 7.5 for adjacent channel selectivity	18.1.0
2024-03	RAN#103	R5-240852	0015	-	F	Corrections on 7.6 for blocking characteristics	18.1.0
2024-03	RAN#103	R5-240853	0016	-	F	Corrections on A.3.2.1.1 for the reference channel for NTN PDSCH requirement	18.1.0
2024-03	RAN#103	R5-240854	0017	-	F	Update of 6.2.1 for maximum output power	18.1.0
2024-03	RAN#103	R5-241148	0026	-	F	Update to PDSCH Mapping Type A test case for Satellite Access	18.1.0
2024-03	RAN#103	R5-241149	0027	-	F	General updates to RF NTN clauses	18.1.0
2024-03	RAN#103	R5-241396	0031	-	F	Updates to NR NTN Minimum output power test	18.1.0
2024-03	RAN#103	R5-241397	0032	-	F	Updates to NR NTN Transmit OFF power test	18.1.0
2024-03	RAN#103	R5-241398	0033	-	F	Updates to NR NTN Maximum Input Level test	18.1.0
2024-03	RAN#103	R5-241440	0034	-	F	Updates to NTN TC 6.3.3 on Tx on-off time mask	18.1.0
2024-03	RAN#103	R5-241441	0035	-	F	Updates to NTN TC 6.5.2.2 on Spectrum emission mask	18.1.0
2024-03	RAN#103	R5-241442	0036	-	F	Updates to NTN TC 6.5.2.4 on ACLR	18.1.0
2024-03	RAN#103	R5-241805	0005	1	F	Corrections on 6.2.3 for additional maximum output power reduction	18.1.0
2024-03	RAN#103	R5-241806	0007	1	F	Corrections on 6.3.3 for Transmit ON OFF time mask	18.1.0
2024-03	RAN#103	R5-241807	0010	1	F	Corrections on 6.5.3 for spurious emission	18.1.0
2024-03	RAN#103	R5-241810	0018	1	F	Update of chapter 4 for RF general description	18.1.0
2024-03	RAN#103	R5-241877	0012	1	F	Corrections on 7.3.2 for Reference sensitivity power level	18.1.0
2024-03	RAN#103	R5-242008	0020	1	F	Update to NTN Add Spurious Emission TC	18.1.0
2024-03	RAN#103	R5-242009	0021	1	F	Update to NTN General Spurious emission TC	18.1.0
2024-03	RAN#103	R5-242010	0022	1	F	Updates to NTN Spur emission UE Coex	18.1.0
2024-03	RAN#103	R5-242011	0023	1	F	Update to NTN Tx Intermod TC	18.1.0
2024-03	RAN#103	R5-242012	0025	1	F	Update to NTN Annex F MU TT	18.1.0
2024-03	RAN#103	R5-242013	0028	1	F	Splitting the NR NTN frequency error test case	18.1.0
2024-03	RAN#103	R5-242018	0029	1	F	UL RMCs updates for NR NTN	18.1.0

History

Document history		
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